Final Report

Hanscom Air Force Base's

Record of Decision (ROD)

for

National Priorities List (NPL) Operable Unit 1

at

Hanscom Field/Hanscom Air Force Base, Massachusetts

September 2007

Prepared by

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Acronyms

AFB	Air Force Base
ARAR	Applicable or Relevant Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	CERCLA Information System
COC	Chemical of Concern
COPC	Chemical of Potential Concern
CSM	Conceptual Site Model
CVOC	Chlorinated volatile organic compound
DCE	Dichloroethylene
DNAPL	Dense Non-Aqueous Phase Liquids
DoD	Department of Defense
ERA	Ecological Risk Assessment
ESC	Electronics Systems Center
ESD	Explanation of Significant Differences
FAA	Federal Aviation Administration
FFS	Focused Feasibility Study
gpm	gallons per minute
H&A	Haley & Aldrich
HI	Hazard Index
HQ	Hazard Quotient
ICs	Institutional Controls
IRP	Installation Restoration Program
LTMP	Long Term Monitoring Program
LUCs	Land Used Controls
MADEP	Massachusetts Department of Environmental Protection
Massport	Massachusetts Port Authority
MCL	Maximum Contaminant Level
MCP	Massachusetts Contingency Plan
mgd	million gallons per day
MSL	mean sea level
NCP	National Oil and Hazardous Substances Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
RAB	Regional Advisory Board
RAO	Remedial Action Objective
ROD	Record of Decision
RPO	Remedial Process Optimization
SARA	Superfund Amendments and Reauthorization Act
SVOC	Semi-volatile organic compound
TCE	Trichloroethylene
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VER	Vacuum Enhanced Recovery
VOC	Volatile organic compound

1.0 Declaration for the Record of Decision (ROD)

Hanscom Field/ Hanscom Air Force Base
CERCLIS ID#: MA8570024424
NPL Operable Unit 1
Bedford and Concord, Massachusetts

1.1 Statement of Basis and Purpose

This decision document presents the selected remedial action for National Priorities List (NPL) Operable Unit 1 (OU-1), at Hanscom Field/Hanscom Air Force Base (AFB) (**Figure 1**). This remedial action was selected in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), 42 USC § 9601 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300 et seq., as amended. The Commander, 66th Air Base Wing, Hanscom AFB, MA has been delegated the authority to sign this Record of Decision (ROD) for the U.S. Air Force (USAF) and the Director of the Office of Site Remediation and Restoration has been delegated the authority to sign this ROD for the U.S. Environmental Protection Agency (USEPA).

This decision was based on the Administrative Record, which has been developed in accordance with Section 113 (k) of CERCLA, and which is available for review at the Hanscom AFB Environmental Office located at 72 Dow Street, Hanscom AFB. The Administrative Record Index (**Appendix A** to this ROD) identifies each of the items comprising the Administrative Record upon which the selection of the remedial action is based.

The Commonwealth of Massachusetts, through the Massachusetts Department of Environmental Protection (MADEP), concurs with the selected remedy.

1.2 Assessment of the Site

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

1.3 Description of the Selected Remedy

This ROD sets forth the selected remedy for OU-1 at the Hanscom Field/Hanscom AFB NPL Site, which involves the continued operation of the existing dynamic groundwater remediation system, land use controls including institutional controls, and the monitoring

of groundwater and surface water. This remedy is expected to remove/destroy the sources of groundwater contamination, effectively contain the migration of groundwater contaminants and is expected to reduce the overall extent of the groundwater plume via a reduction in contaminant mass. The following are the major components of the selected remedy:

- Operate the existing dynamic groundwater remediation system (groundwater collection, treatment and recharge system; vacuum enhanced recovery system; molasses and/or permanganate injections).
- Maintain and enforce Land Used Controls (LUCs), including Institutional Controls (ICs), to prevent exposure to hazardous substances above permissible levels.
- An environmental sampling program (including groundwater and surface water) to monitor the performance of the groundwater remediation system and to monitor progress towards achievement of the Remedial Action Objectives (RAOs).
- Five-Year Reviews as long as any hazardous substances, pollutants or contaminants remain at the site above levels that allow for unrestricted exposure and unlimited use to assure that the cleanup remedy continues to protect human health and the environment.

The primary objectives of the remedial measures are to:

- Prevent exposure (via ingestion, inhalation and/or dermal contact) to groundwater containing COC concentrations that exceed federal drinking water standards (i.e., MCLs and non-zero MCLGs, state drinking water standards (i.e., MCLs), and state groundwater risk characterization standards (i.e., MCP Method 1 GW-1 standards);
- Prevent further migration of dissolved-phase COCs in groundwater;
- Prevent discharge to surface-water bodies and wetlands of groundwater containing COC concentrations that exceed federal drinking water standards, state drinking water standards, and state groundwater risk characterization standards; and
- Within an acceptable time period (<30 - 50 years), return groundwaters to federal drinking water standards, state drinking water standards, and state groundwater risk characterization standards.

Secondary objectives are to ensure that excavation at the three source areas (Sites 1, 2 and 3) is controlled to prevent exposure to any residual contamination in the subsurface soil and to prevent exposure to vapors that could accumulate in buildings affected by the contaminated groundwater plume.

The Department of Defense (DoD) initiated its Installation Restoration Program (IRP) concurrently with the CERCLA (as amended by SARA) with the overall goal of cleaning up contamination on installations. The U.S. Air Force began implementing the IRP at L.G. Hanscom Field and Hanscom AFB during the 1980s with initial surveys and records reviews to identify potentially contaminated sites. This effort identified thirteen specific sites with known or suspected contamination to be included in the restoration program. Subsequent discoveries have increased the number of IRP Sites to twenty two. Fourteen (14) of these sites have been closed with regulatory concurrence and eight (8) have remedial actions in-place/on-going. Initially the Massachusetts Department of Environmental Protection

(MADEP) was the lead regulatory agency for the Hanscom IRP until Hanscom AFB, including Hanscom Field, was listed on the NPL in May 1994. At this time USEPA became the lead regulatory agency for CERCLA regulated sites whereas MADEP retained the lead role for sites excluded from the purview of CERCLA under CERCLA's petroleum exclusion clause. These petroleum sites are deferred to the state for regulation under the Massachusetts Contingency Plan (MCP) (the Commonwealth's Superfund Law). Of the 8 IRP Sites with remedial actions in-place/on-going two (2) are MCP sites and the remaining 6 IRP sites are CERCLA regulated sites. These 6 have been grouped into Operable Units (OUs) to facilitate future response actions. Operable Unit 1, the subject of this ROD, includes IRP Sites 1, 2, and 3.

The selected remedy is a comprehensive approach for OU-1 that addresses current and potential future risks caused by groundwater and any residual soil contamination. Specifically, this remedial action addresses three distinct areas of concern (IRP Sites 1, 2, and 3) within OU-1 which are all located on L.G. Hanscom Field. Remedial actions have already been conducted in confirmed plume source areas within OU-1 (IRP Sites 1, 2 and 3 which are summarized in Section 2.2). The nature of contamination at OU-1 includes residual dense non-aqueous phase liquids (DNAPL), dissolved-phase volatile organic compounds (VOCs) and the potential for residual soil contamination in plume source areas. This contamination is a result of various historical USAF activities on L.G. Hanscom Field associated with fire training and/or the disposal of waste fuels, oils, solvents, paint, paint thinners, degreasers and other waste liquids.

Principal threats that this ROD addresses include human contact and/or ingestion of contaminated groundwater and human contact with potentially contaminated soil. Principal chemicals of concern include trichloroethylene (TCE), cis-1,2-dichloroethylene (DCE), and vinyl chloride in groundwater. The selected response action addresses principal threats at OU-1 by preventing the further migration of, and, over time, eliminating contaminated groundwater on Hanscom Field/Hanscom AFB property and off-site (e.g., Town of Bedford conservation lands); by removing and/or destroying contaminant mass at the source areas; by maintaining and enforcing land use controls/institutional controls to prevent exposure to, and use of, contaminated groundwater and to ensure that excavation at the three source areas is controlled to prevent exposure to any residual contamination in the subsurface soil and to prevent exposure to vapors that could accumulate in buildings effected by the contaminated groundwater plume; and continuing a long-term monitoring program.

1.4 Statutory Determinations

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment technologies (vacuum enhanced recovery and injection of molasses and/or permanganate) to the maximum extent practicable. This remedy also satisfies the statutory preference for treatment as a principal element of the remedy.

Because this remedy will result in hazardous substances initially remaining on-site above levels that allow unrestricted exposure and unlimited use and, and groundwater and land use restrictions are necessary, a statutory review will be conducted to ensure that the remedy continues to provide adequate protection of human health and the environment every five years after initiation of the remedial action until groundwater contamination is below levels that allow for unlimited use and unrestricted exposure.

1.5 ROD Data Certification Checklist

The following information is included in the Decision Summary section of this ROD. Additional information can be found in the Administrative Record file for this site.

1. Chemicals of concern (COCs) and their respective concentrations
2. Baseline risk represented by the COCs
3. Cleanup levels established for COCs and the basis for the levels
4. Current and future land and ground-water use assumptions used in the baseline risk assessment
5. Potential land and groundwater use that will be available at the site as a result of the selected remedy
6. Estimated capital, operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected
7. Key factor(s) that led to selecting the remedy

1.7 Authorizing Signatures

This ROD documents the selected remedy for groundwater at OU-1 at Hanscom AFB. The USAF selected this remedy with concurrence of the U.S. Environmental Protection Agency and the Massachusetts Department of Environmental Protection.

U.S. Air Force

By: _____ Date: 14 Sep 07

Thomas J. Schluckebier
Colonel, USAF
Commander
66th Air Base Wing

U.S. Environmental Protection Agency

By: _____ Date: Sept 28, 2007

James T. Owens III
Director
Office of Site Remediation and Restoration
Region 1

2.0 Decision Summary

2.1 Site Name, Location and Brief Description

2.1.1 Name and Location

Hanscom Field/Hanscom AFB - This site is located in Middlesex County, Massachusetts, approximately 14 miles northwest of downtown Boston and includes land in the towns of Bedford, Concord, Lexington, and Lincoln, Massachusetts. The OU-1 area addressed in this ROD includes parts of Hanscom Field, Hanscom AFB and the wetland and forest areas to the north/northeast of the runways that is owned by the Town of Bedford (**Figure 1**). IRP Sites 1 and 2 are located in Bedford and Site 3 is in Concord.

2.1.2 Comprehensive Environmental Response, Compensation, and Liability Act Information System Identification Number

The Comprehensive Environmental Response, Compensation and Liability Act Information System (CERCLIS) identification number for Hanscom Field/ Hanscom AFB is CERCLIS ID# MA8570024424.

2.1.3 Lead Agency

The USAF is the lead agency with regulatory oversight from USEPA (lead regulator) and the MADEP (support regulator).

2.1.4 Site Description

Hanscom AFB is an active base owned and operated by the Federal government through the Department of the Air Force. Hanscom AFB is home to the Electronics Systems Center (ESC), a dynamic nucleus of research and development. ESC is the USAF's acquisition and development center for world-class command and control systems.

L.G. Hanscom Field, located adjacent to and north of the Base, is a full-service General Aviation airport owned by the Commonwealth of Massachusetts and operated by the Massachusetts Port Authority (Massport) and the Federal Aviation Administration (FAA). However, Hanscom Field was leased from the Commonwealth and used as a military airport by the Air Force from 1942 to 1973.

Topographically, Hanscom Field and Hanscom AFB are located in a low-lying basin surrounded by hills. The relatively flat runway portion of Hanscom Field lies in the ancient lake bed of glacial lake Concord. The ground surface elevation on this former lake bed ranges from 120 to 130 feet above mean sea level (MSL). The hills south of the air base, and Pine Hill to the west, rise to more than 200 feet MSL. Hills north of the airfield area are more subdued, but still rise above 150 feet MSL. Former Glacial Lake Concord and Hanscom AFB on its southern edge drain to the Shawsheen River, which flows north-northeast from the site to join the Merrimack River approximately 15 miles downstream.

DoD initiated its IRP concurrently with CERCLA (as amended by SARA) with the overall goal of cleaning up contamination on installations. The USAF began implementing the IRP at L.G. Hanscom Field and Hanscom AFB during the 1980s with initial surveys and records reviews to identify potentially contaminated sites. Hanscom AFB, including Hanscom Field, was listed on the USEPA National Priorities List (NPL) in 1994. 14 of the 22 IRP sites identified with known or suspected contamination have been have been closed with regulatory concurrence and the remaining 8 have remedial actions in-place/on-going. Of the 8 IRP Sites with remedial actions in-place/on-going two (2) are MCP sites and the remaining 6 IRP sites are CERCLA regulated sites. The CERCLA sites were grouped into three operable units, defined as follows:

Operable Unit 1
IRP Site 1: Fire Training Area II
IRP Site 2: Paint Waste Disposal Area
IRP Site 3: Jet Fuel Residue/Tank Sludge Disposal Area
Operable Unit 2
IRP Site 4: Sanitary Landfill
Operable Unit 3
IRP Site 6: Landfill/Former Filter Beds
IRP Site 21: Unit 1 Petroleum Release Site

The location of the three Operable Units is shown in **Figure 1**. A more complete description of the site can be found in Section 1.3 - Background Information of the 2007 Revised Focused Feasibility Study (FFS), NPL Operable 1, Hanscom AFB, Massachusetts (Hanscom AFB, May 2007).

2.2 Site History and Enforcement Activities

2.2.1 History of Site Activities

Prior to 1973, Hanscom AFB leased the runways and flight line, that are now Hanscom Field, from the Commonwealth and the primary mission of Hanscom AFB was the operational maintenance of fighter aircraft and research and development support. During the period that the Air Force leased the runways and flight line, hazardous wastes were generated by support operations and disposed of at different areas on Hanscom Field. In addition, fire training exercises were routinely conducted at one or more areas on Hanscom Field. As noted above, OU-1 includes IRP Sites 1, 2, and 3, (Figure 1) which are all located on Hanscom Field and for which the Air Force is the principal responsible party.

2.2.1.1 Site 1 - Fire Training Area II

Site 1 is located northwest of Runway 5-23 at the north end of the airfield and was reportedly used from the late 1960s through 1973 for fire training exercises. Waste oils, solvents, paint thinners, and degreasers were collected from around the base, dumped into pits, ignited, and then extinguished. Occasionally, aircraft wrecks and fuselages were burned in the pits. Two separate pits were used over the years of training exercises. The size of each pit was estimated to be 15 feet by 20 feet. There is no information indicating that liners or containment was used at this site.

2.2.1.2 Site 2 - Paint Waste Disposal Area

Site 2 is located north of Runway 11-29 and east of Runway 5-23 in the northeast portion of the airfield and was used for disposing of waste solvents and paint from 1966 to 1972. Metal plating wastes may also have been disposed in this area from the early 1960s through 1972. There is no information indicating whether any type of liner or containment was used at this site.

2.2.1.3 Site 3 - Jet Fuel Residue/Tank Sludge Disposal Area

Site 3 is located at the western portion of the airfield in a triangular area bounded by Taxiway "Whiskey" to the north, Taxiway "Mike" to southwest and Runway 5-23 to the southeast . Several hundred drums of waste airplane fuels, oil, and paint were buried at Site 3 between 1959 and 1969. Leaking drums were reported at Site 3 at the time of burial. There is no information indicating whether any type of liner or containment was used at this site.

2.2.2 History of Federal and State Investigations and Removal and Remedial Actions

The Air Force is the responsible party for all sites at OU-1. DoD initiated its IRP concurrently with the CERCLA (as amended by SARA) with the overall goal of cleaning up contamination on installations. The USAF began implementing the IRP at Hanscom Field/Hanscom AFB in 1982 when Roy F. Weston, Inc. was retained by Hanscom AFB to conduct a hydrogeologic investigation at Hanscom Field to assess the potential for water quality degradation at the Town of Bedford's Hartwell Road wellfield as related to past waste disposal activities at Hanscom Field. In 1984 JRB Associates, Inc. was retained by Hanscom AFB to complete an Installation Assessment/Records Search. The purpose of this investigation was to identify the potential for environmental contamination from past USAF waste management and training practices, evaluate the probability of contaminant migration, and assess the potential hazard posed by historical USAF activities. This effort identified 13 specific sites to be included in the restoration program. Subsequent discoveries have increased the number of IRP sites to 22. In 1985 Haley & Aldrich, Inc. (H&A) was retained by Hanscom AFB to conduct investigations and prepare Remedial Action Plans for Sites 1 through 5 on L.G. Hanscom Field. Subsequently, in 1988, the "Final" Remedial Action was completed for the closed base municipal landfill (OU-2/Site 4) and Removal Actions (removal of buried drums and/or visibly contaminated soil) were completed at three high risk sites on L.G. Hanscom Field (IRP Sites 1, 2 & 3). The above investigations, Remedial Action Plans and Removal Actions were conducted under the Air Force initiated CERCLA based IRP with the MADEP as the lead regulatory agency.

In August 1996, in order to determine the magnitude and extent of any residual soil contamination at the confirmed OU-1 plume source areas (IRP Sites 1, 2 and 3), Hanscom AFB partnered with USEPA Region I and Tufts University on a soil sampling program under CERCLA. For Hanscom AFB, the purpose of the soil sampling and analysis was to determine if residual soil contamination warranted additional remedial efforts. The data also was used to evaluate the effectiveness of response efforts to date. More details on the results of this soil sampling and analysis are provided in CH2M Hill's Final Report dated 19 January 1998, entitled: OU-1 Field Report, Hanscom AFB. For USEPA Region I and Tufts the soil sampling and analysis program was part of USEPA's Environmental Technology Initiative (ETI). This ETI project was the demonstration of a dynamic site investigation

using Adaptive Sampling and Analysis with the goal of demonstrating the capability of field analytical technologies in the context of producing data of sufficient quality to support remedial decisions in a cost-effective manner. USEPA published the results of this effort as USEPA document USEPA-542-R-98-006, dated September 1998, and entitled: *Innovations in Site Characterization, Case Study: Hanscom Air Force Base, Operable Unit 1 (Sites 1, 2 and 3).*

2.2.2.1 Site 1 - Fire Training Area II

Contaminated soils were excavated from three areas at Site 1 in 1988 (Burn Pit #1, Burn Pit #1 Runoff Area, and Burn Pit #2) (**Figure 2**). A total of 2,160 tons of visibly contaminated soil was removed and transported to disposal facilities. Post-excavation survey data indicate that excavation depths averaged three to four feet in the two Burn Pits, and one to two feet in the Burn Pit #1 Runoff Area. These areas were backfilled with clean fill material.

2.2.2.2 Sites 2 & 3 - Paint Waste Disposal Area Jet Fuel Residue/ Tank Sludge Disposal Area

Buried drums were excavated from Sites 2 and 3 in January and February, 1988. The majority of the drums were empty and only 660 gallons of liquids were recovered. Site 2 contained 4 drum excavation pits (**Figure 3**) and Site 3 contained 10 drum excavation pits (**Figure 4**). A total of 1,896 tons of visibly contaminated soil was removed from the pits along with the drums and transported to licensed off-site disposal facilities. The pits were backfilled with the remaining excavated soil and clean fill material with the intent that any residual contamination would be captured by the groundwater collection trench installed around the perimeter of the site.

2.2.2.3 Response Actions for OU-1 Groundwater

Groundwater beneath OU-1 is contaminated with volatile organic compounds (VOCs) as the result of historical USAF activities and the Remedial Action Plans developed for IRP Sites 1, 2, and 3 by Haley & Aldrich (H&A) in 1988 included a groundwater collection, treatment and recharge system to address the OU-1 groundwater contamination. This system has operated continuously (except for maintenance and repair periods) ever since it was placed in operation in April 1991

The original system consisted of groundwater collection trenches at Site 1, 2, and 3; four boundary interceptor wells aligned along a transect near Sites 1 and 2 and the northeast boundary of Hanscom Field with the conservation lands owned by the Town of Bedford; and recharge basins at Sites 2 and 3 (**Figure 5**). In 1997, a Vacuum Enhanced Recovery (VER) system with four recovery wells was placed in operation in the immediate vicinity of Burn Pit #1 Runoff Area at Site 1 (**Figures 5 and 6**). Also in 1997, two additional conventional interceptor wells were placed in operation, one downgradient (southeast) of Site 1 and the other downgradient (north) of Site 2. In 1999, the VER system at Site 1 was augmented by the conversion of 3 monitoring wells in the immediate area to conventional interceptor wells. Also in 1999 another conventional interceptor well was installed at the Site 1 Burn Pit #2 area and in 2006 a conventional interceptor well was installed midway between Site 1 and the boundary.

All of the collected groundwater is pumped to a central treatment facility located between Sites 1 and 2, where an air stripper is used to remove contaminants from the collected groundwater. The treated water is then either recharged back into the ground at Site 2 and/or Site 3 and/or discharged into a drainage channel on the east side of Runway 5-23. The drainage channel discharges into the wetlands/beaver ponded area northeast of

Runway 5-23. The OU-1 system has treated between 100 to 320 gallons per minute since it became operational and, as of the end of 2006, more than 1.7 billion gallons of groundwater had been treated.
In addition to the above groundwater pump and treat action sodium permanganate has periodically been injected in the immediate vicinity of Burn Pit #1 Runoff Area at Site 1 to chemically destroy contaminants (with harmless by-products) and an in-situ reactive zone (IRZ) was created midway between Site 1 and the boundary (**Figure 7**) by the periodic injection of molasses. The injection of molasses creates suitable in-situ conditions for the biodegradation of the chlorinated aliphatic hydrocarbons which make up the OU-1 groundwater contamination.

In 2000 the IROD for OU-1 identified the above described dynamic groundwater remediation system as the selected Interim Remedy for OU-1 Groundwater.

2.2.3 History of CERCLA Enforcement Activities

When Hanscom Field/Hanscom AFB was designated a NPL site in May 1994 OU-1/IRP Sites 1, 2 and 3 became regulated under CERCLA rather than the Massachusetts Contingency Plan (MCP). At that time the Commonwealth of Massachusetts determined that the site was "Adequately Regulated" and deferred to the federal requirements.

In 1994, all parties agreed that Hanscom AFB should continue the on-going OU-1 groundwater remediation efforts while concurrently addressing the issues raised by the Superfund designation. Subsequently Hanscom AFB completed the following for OU-1: soil sampling and analysis at each of the 3 source areas, applicable risk assessments, groundwater modeling, a May 2000 Focused Feasibility Study, a June 2000 Interim Proposed Plan, and a November 2000 Interim Record of Decision (IROD). The IROD (Air Force signed 24 January 2001 and USEPA signed on 6 February) was issued at that time to select an interim remedy which would be protective of human health and the environment in the interim while additional information was gathered to support the selection of a final remedy. Please note the 2000 IROD re-confirmed the Remedial Action Plans developed and implemented in the 80's that were under the auspices of the Massachusetts Department of Environmental Quality Engineering (MADEP predecessor).

Since 2000 significant progress (discussed in 2.13, The Selected Remedy) has been made towards the cleanup of OU-1 and additional information has been gathered which would support the selection of a final remedy. Therefore, in 2007, a Focused Groundwater Flow and Transport Model (May 2007), a Revised Focused Feasibility Study of OU-1 (May 2007), and a Proposed Plan (May 2007) have been prepared to support this Final Record of Decision (ROD) for OU-1.

2.3 Community Participation

Throughout the site's history, community concern and involvement have been high. Hanscom AFB has kept the community and other interested parties apprised of site activities through informational meetings, fact sheets, press releases and public meetings. Below is a brief chronology of public outreach efforts.

- In the early 1980s, public briefings were periodically conducted during Hanscom Field Advisory Commission meetings regarding the Preliminary Assessment/Site Inspection phases of the CERCLA process.
- In the early 1980s, there was significant newspaper coverage of Hanscom AFB's Preliminary Assessment/Site Inspection/Remedial Action status.
- Letter sent to regulators and other stakeholders providing status of Remedial Action Plans for Sites 1 through 5 and announcing a public informational meeting on June 30, 1987.
- On June 30, 1987 a public informational meeting was held regarding the Remedial Action Plans for Site 1 through 5 at OU-1.
- On April 4, 1989, the Massachusetts Division of Water Pollution Control, Department of Environmental Quality Engineering, Executive Office of Environmental Affairs, provided the State Secretary with a copy of the public notice for a groundwater discharge permit determination for publication in the Central Register. Also on April 4, 1989 the Division of Water Pollution Control requested that the Bedford Minuteman newspaper publish a legal notice concerning Hanscom AFB's groundwater discharge permit application.
- On March 21, 1990, a copy of an Application for Variance and Environmental Notification Form was sent to the regulators (USEPA and MADEP) and other stakeholders. Notices of a 30-day public review/comment period were placed in the Bedford Minuteman and the Environmental Monitor.
- On June 4, 1990 - MEPA notice of a consultation session on June 13, 1990 to receive comments from regulators and other stakeholders on Hanscom AFB's groundwater remediation.
- On June 13, 1990 a consultation session was held regarding Hanscom AFB's groundwater remediation.
- Technical Review Committee meetings were conducted on June 1, 1993 and December 15, 1993.
- The Technical Review Committee was expanded to become the Restoration Advisory Board (RAB) which has held meetings periodically since November 29, 1994.
- On May 18, 2000 the project team (Hanscom AFB, USEPA, and MADEP) held a meeting with Bedford Town officials to discuss the Interim Proposed Plans for OU-1 (and Proposed Plans for OU-3/Site 6), the Federal Facility Agreement being established between Hanscom AFB and the USEPA, and the situation concerning monitoring well RAP1-7 in the Bedford Community Gardens.
- On June 8, 2000, copies of the Fact Sheet describing the Interim Proposed Plan and information of the public comment period, public meeting, and public hearing were mailed to everyone on the RAB mailing list.
- On June 8, 2000, copies of the Interim Proposed Plan and associated Fact Sheet and information regarding the public comment period, public meeting, and public hearing were mailed to the Town of Bedford and Concord (Town Manager, Board of Health, and Conservation Commission) and Massport (Hanscom Field Manager and Environmental Unit).
- On June 8, 2000, Hanscom AFB and USEPA published a notice and brief analysis of the Interim Proposed Plan in the local and Hanscom AFB newspapers and made the

plan and associated Fact Sheet available to the public at the Bedford and Concord Town Libraries, and the Hanscom AFB Library. The notice included the time and date of the public meeting and hearing.

- From June 9 to July 10, 2000, Hanscom AFB and USEPA held a 30 day public comment period to accept public comment on the alternatives presented in the Focused Feasibility Study and Interim Proposed Plan.
- On June 28, 2000, Hanscom AFB and USEPA held an informational meeting at the Bedford Town Hall to discuss the results of the Remedial Investigation and the cleanup alternatives presented in the Focused Feasibility Study and to present the Air Force's Interim Proposed Plan to a broader community audience than those that had already been involved at the site. It should be noted that the fact that the Air Force was seeking an ARARs waiver on the grounds that the selected remedy is an interim action was announced to the public in the Interim Proposed Plan. At this meeting, representatives from USEPA and Hanscom AFB responded to questions from the public.
- On June 28, 2000, Hanscom AFB and USEPA held a public hearing at the Bedford Town Hall to accept any oral comments on the Interim Proposed Plan. A transcript of this meeting and the comments and responses to comments are included in the Responsiveness Summary included as Appendix B to the November 2000 OU-1 IROD .
- In February 2001 the Interim Record of Decision selecting an interim remedy for OU-1 was finalized (signed by the Air Force on January 24, 2001 and by the USEPA on February 6, 2001). A copy of this IROD was placed in the Bedford Town Library and the Hanscom AFB library. A Public Notice summarizing and announcing availability of this IROD was published in local and Hanscom AFB newspapers.
- On June 7, 2007 a Public Notice announcing the June 8 through July 9, 2007 public review/comment period on the 2007 Proposed Plan for NPL OU-1 was published in local and Hanscom AFB newspapers. In addition to the dates of the review/comment period this notice included a brief analysis of the 2007 Proposed Plan, the time and date of a public informational meeting and a hearing concerning the of the 2007 Proposed Plan, and the availability of the 2007 Revised FFS and Proposed Plan in the Bedford and Hanscom Libraries,
- On June 7, 2007 copies of the Proposed Plan and information on the public comment period, public meeting and hearing were mailed to Bedford (Town Manager, Board of Health & Conservation Commission), Concord (Town Manager & Board of Health), Massport (Hanscom Field Airport Director & Environmental Unit) and Navy.
- From June 8 through July 9, 2007 copies of the 2007 Revised FFS and Proposed Plan were on file at the Bedford Town Library and the Hanscom AFB Library for the duration of the Public Review/Comment Period.
- From June 9 to July 10, 2007 Hanscom AFB and USEPA accepted comments from the public concerning the 2007 Proposed Plan for NPL OU-1.
- On June 20, 2007, Hanscom AFB and USEPA held an informational meeting at the Bedford Town Hall to discuss the cleanup alternatives presented in the 2007 Revised FFS and to present the Air Force's Proposed Plan to a broader community audience than those that had already been involved at the site. At this meeting,

representatives from USEPA and Hanscom AFB responded to questions from the public.

- On June 20, 2007, Hanscom AFB and USEPA held a public hearing at the Bedford Town Hall to accept any oral comments on the Air Force's Proposed Plan. The comments and responses to comments are included in Section 3.0, Responsiveness Summary and a transcript of the public hearing is included as Appendix B.
- On-going - the Administrative Record for the Hanscom AFB IRP is maintained at Hanscom AFB Environmental Office and is available for review by the public.

2.4 Scope and Role of Response Action

As stated in Section 2.1.4 and as shown on **Figure 1** Hanscom AFB CERCLA sites have been grouped into 3 Operable Units. A summary of the CERCLA regulatory status for each of the OUs is as follows:

- This ROD addresses OU-1 and it is a follow-on to the November 2000 IROD for OU-1. The IROD's selected interim remedial action (operation of the dynamic groundwater collection and treatment system at OU-1) has been implemented. Also as noted earlier the 2000 IROD re-confirmed the Remedial Action Plans developed and implemented in the 80's. Also, the August 2002 Second Five-Year Review Report for the Hanscom Field/Hanscom AFB Superfund Site included the determination that the remedy at OU-1 is protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled. The next Five-Year Review of the OU-1 Remedial Action is scheduled to be completed in September 2007.

- OU-2 is IRP Site 4, the former municipal landfill for Hanscom AFB. Is currently in the Remedial Action-Operation Phase. A Remedial Action Plan was finalized in 1988 and construction of the remedy (which included a low permeable cap, drainage measures and a compensatory wetland) was completed in the fall of 1988. Long-term monitoring of groundwater and surface water was conducted between December 1989 and September 1992. The preceding actions were conducted prior to the listing of Hanscom Field/Hanscom AFB on the NPL with the MADEP as the lead regulatory agency. In 1995 the Commonwealth deferred oversight to the USEPA. In 1996 an ecological analysis was completed and supplemental monitoring of sediments, groundwater and surface water was completed in 1995 and 1996. In 1997 a Human Health Risk Assessment and an Ecological Risk Assessment were completed. Subsequently USEPA accepted the 1988 Remedial Action for OU-2 (IRP Site 4, Sanitary Landfill) as the final remedy and the first five-year review of the Hanscom Field/Hanscom AFB NPL Site was completed in 1997. This review concluded "based on the field inspection, and human health and ecological risk assessment, protectiveness of the landfill cap at Site 4 has been demonstrated." Also, the August 2002 Second Five-Year Review Report for the Hanscom Field/Hanscom AFB Superfund Site included the determination that the remedy OU-2 is protective of human health and the environment. The next Five-Year Review of the OU-2 Remedial Action is scheduled to be completed in September 2007.

- There are two (2) IRP sites associated with OU-3, IRP Sites 6 and 21.

  - OU-3/IRP Site 6 (landfill/former filter bed areas) is currently in the Remedial Action-Operation Phase. The ROD for OU-3/IRP Site 6 was signed in December 2000, the Remedial Design was completed in April 2001 and construction of the remedy was substantially completed in September 2001 at which time the site began the Remedial Action-Operation Phase. Also, the August 2002 Second Five-Year Review Report for the Hanscom Field/Hanscom AFB Superfund Site included the determination that the remedy at OU-3/IRP Site 6 currently protects human health and the environment in the short-term because construction has been completed and land use/institutional controls have been implemented. The Second Five Year Review stated "However, in order for the remedy to be protective in the long-term, the following actions need to be taken: conduct groundwater, liquid seep and surface water monitoring to confirm that natural flushing and natural attenuation are reducing the size and strength of the contaminant plume within the compliance boundary and that groundwater quality is being met outside the compliance boundary. It is expected that it will take approximately three to five years to collect sufficient data to make a final protectiveness determination." The next Five-Year Review of the OU-3/IRP Site 6 Remedial Action (which is scheduled to be completed in September 2007) will address the effectiveness of the actions taken since 2002.

  - OU-3/IRP Site 21 (former aviation fuels area) is currently in the Remedial Action-Operation Phase. The ROD for OU-3/IRP Site21 was signed in August 2002, the Remedial Design was completed in May 2003 and construction of the remedy was completed in September 2003 at which time the site began the Remedial Action-Operation Phase. The next Five-Year Review of the OU-3/IRP Site 21 Remedial Action (which is scheduled to be completed in September 2007) will address the effectiveness of the actions taken since 2002.

2.5 Site Characteristics

Chapter 1.0 of the 2007 Revised FFS contains an overview of the Remedial Investigation. The significant findings of the Remedial Investigation are summarized below.

2.5.1 Site Overview

2.5.1.1 Regional Climatology

The climatic conditions at the site are generally characterized as being a continental climate somewhat influenced by the Atlantic Ocean to the east. Weather patterns vary considerably on a year to year and daily basis due to the prevailing northeasterly winds (EA, 1994). According to the EA Report, average annual precipitation is 44 inches, average annual snowfall is 56.6 inches, maximum 24-hour precipitation is 8.7 inches, and maximum 24-hour snowfall is 16.5 inches (based on 87 years of record keeping). Evapotranspiration ranges between 22 and 28 inches per year.

2.5.1.2 Topography and Surficial Geology

The topography and surficial geology of the OU-1 area is illustrated in **Figure 8**. Topographically, the central part of the area is a low-lying basin surrounded by hills. The relatively flat runway portion of L.G. Hanscom Field lies in the ancient lake bed of glacial Lake Concord. The ground surface elevation on this former lake bed ranges from 120 to 130 feet above mean sea level. The hills south of the air base, and pine hill to the west, rise to more than 200 feet mean sea level. Hills north of the airfield area are more subdued, but still rise above 150 feet mean sea level.

2.5.1.3 Regional Geology

The bedrock unit underlying most of the Hanscom Field/Hanscom AFB area is known as the Andover Granite, which is part of the plutonic series of the Nashoba Block. The Andover Granite is characterized by a series of foliated and unfoliated, garnet-bearing, muscovite-biotite granites and pegmatite (Hepburn and Munn, 1984). The northeast portion of the Site is underlain by the Assabet Quartz Diorite and the Shawsheen Gneiss. The Assabet Quartz Diorite is part of the Nashoba Block plutonic series and the Shawsheen Gneiss is part of the metamorphosed stratified rock sequence of the Nashoba Block.

The Bloody Bluff fault zone is approximately one mile east of Hanscom Field/Hanscom AFB. This fault zone forms the southeasterly boundary of the Nashoba Block. Younger and less extensive north-northeast trending faults have been mapped to the north and south of the Hanscom Field/Hanscom AFB area. These faults likely extend beneath the Site.

Erosional and depositional processes active during the Pleistocene glaciation modified the landscape in the region until the final retreat of glacial ice from the area approximately 13,000 years ago. As the ice retreated from the area, glacial meltwaters formed glacial Lake Concord between the ice front to the north and the hills south of Hanscom AFB. Glacial meltwaters transported and deposited sediments within the lake.

In the vicinity of the Hanscom Field/Hanscom AFB, glacial sediments consist mainly of glacial outwash materials (material deposited by glacial meltwaters), glacial lacustrine deposits formed in glacial Lake Concord, and glacial till deposits formed in contact with glacial ice. The lacustrine deposits are discontinuous since Lake Concord did not submerge the topographically elevated areas. These elevated areas are generally composed of glacial till sediments and bedrock.

Outwash sediments overlie much of the lacustrine deposits. These sediments consist of silts and fine to coarse sands. In addition to the naturally occurring deposits, extensive areas of Hanscom AFB and Hanscom Field have been filled and graded for construction purposes (JRB Associates, 1984).

Glacial till immediately overlying bedrock around Hanscom Field/Hanscom AFB consists of either a brown or gray course to fine sand with some gravel and silt (JRB Associates, 1984). The glacial till unit is relatively thin to absent at the site (Koteff, 1964). Glacial lacustrine (lake bed) sediments in the vicinity of the Hanscom Field/Hanscom AFB consist mainly of fine sand and silt grading with depth to clayey silts (JRB Associates, 1984). Koteff, 1964, indicated that the lacustrine sediments at Hanscom Field average 25 feet in thickness.

These deposits overlie a discontinuous, thin lens of glacial till and in some places directly overlie bedrock.

2.5.1.4 Hydrology

Former Glacial Lake Concord and Hanscom AFB on its southern edge drain to the Shawsheen River, which flows north-northeast from the site to join the Merrimack River approximately 15 miles downstream. The river starts just north of State Road 2A (North Great Road), which corresponds approximately to a drainage divide. It flows northward through the main housing and administrative area of Hanscom AFB, sometimes as an open channel and sometimes through culverts. Prior to the construction of the air base, much of the ancient lake bed south of the present runways was wetlands. The air base now has an extensive storm drain network, but there are still isolated wetland areas. After emerging from culverts north of Katahdin Hill, the Shawsheen River flows as an open stream northward past the east-end of the east-west runway and out of the area to the east and north.

The western and northern portions of the ancient lake bed are drained by Elm Brook. This stream originates just south of State Road 2A, flows northward on the west side of Pine Hill, passes north of Hartwells Hill, and joins the Shawsheen River. Another surface drainage feature not explicitly shown on the topographic maps is in the wetland area east of Hartwells Hill. This wetland, shown as Qs (Quaternary swamp deposits) in **Figure 8**, is part of the conservation lands owned by the Town of Bedford. It contains a network of drainage channels that start in a ditch running along the east side of the north end of the runway. The un-named stream then flows to the northeast through the wetlands/conservation lands owned by the Town of Bedford and joins Elm Brook just upstream of its confluence with the Shawsheen River.

In addition to this natural hydrologic process, there are several man-made influences affecting groundwater flow. At present, the strongest artificial influence is the recharge and subsurface drainage associated with the groundwater remediation systems at Sites 1, 2, and 3. Each of these sites has a pumped groundwater recovery trench. The remediation systems at Sites 2 and 3 include artificial recharge fields enclosed within the circumferential trenches. These recharge fields, however, are only sporadically used and the majority of the treated water is discharged to the drainage ditch reference in the paragraph above. The Hanscom AFB groundwater remediation system also includes 11 interceptor wells located in the vicinity and north of Sites 1 and 2. Together, the trenches and interceptor wells of this system pump 100 to 300 gallons per minute (gpm) of groundwater. There are also smaller groundwater recovery systems operated by the U.S. Navy and by Raytheon Missile systems. These are located on the northwest side of Hartwells Hill, between the hill and Elm Brook. A third potential influence on groundwater flow in the area is the Town of Bedford's Hartwell Road Wellfield. The wellfield, located west of Hartwell Hill, is not currently in operation. However, it has a pumping capacity of approximately 0.82 million gallons per day (mgd), or 570 gpm, which would have an effect on groundwater flow if operation were to resume.

The U.S. Geological Survey (USGS) has established a temporary stream gauging station in the headwaters of the Shawsheen River where it exits from culverts on the north side of Katahdin Hill. Flow records for 1995 and 1996 indicate a minimum flow of about 1.4 cubic

feet per second at this gauge. This was taken as an estimate of the base flow of the stream at this point. It includes groundwater seepage into the storm drain system under the Hanscom Field/Hanscom AFB area. Depth to groundwater ranges from 5 to 10 feet below ground surface across the Hanscom Field/Hanscom AFB area. These drains are observed to flow even when there has been no rain for several weeks.

2.5.1.5 Hydrogeology

Groundwater flow occurs both in the fractured and weathered bedrock under the OU-1 area and in the unconsolidated sediments above the bedrock. The bedrock is predominantly granite, but some zones of gneiss, schist, and diorite have been encountered. Most borings have encountered numerous fractures, some filled with silt. No predominant direction of fracturing has been identified. Rock Quality Designations range from 10 to 100% with an average of 85%. The majority of the borings penetrated less than 50 feet into bedrock. It is not known how deep into the bedrock that significant groundwater flow persists. A review of bedrock production wells in the vicinity of Hanscom Field/Hanscom AFB revealed seven wells with depths of bedrock penetration ranging from 71 feet to 1004 feet.

The unconsolidated sediments from the top of bedrock to the ground surface can best be characterized by distinguishing between the low-lying areas of the glacial Lake Concord basin and the surrounding hills. In the ancient lake bed, the unconsolidated sediments are glacial and lacustrine deposits that form two transmissive zones separated by a semi-confining unit. The lower transmissive zone is in direct contact with the bedrock. It generally includes a sandy glacial till lying directly on the rock surface, and a coarser sand and gravel outwash. The thickness of this unit varies from 0 to 60 feet, pinching out at the bases of the hills. Above this lower aquifer, is a lacustrine silt and clay layer of relatively low hydraulic conductivity. This semi-confining unit is not continuous, as it pinches out at the hills and has been eroded away under Elm Brook just north of Hartwells Hill. Its thickness varies from 0 to more than 50 feet. The upper transmissive zone is a lacustrine sand unit. In some areas this sand is well sorted, and in others it includes grain sizes ranging from very fine sand and silt to fine gravel. The thickness of the lacustrine sand varies from 0 to 30 feet.

The hills are composed of a raised bedrock surface covered with glacial till. In some areas, such as Hartwells Hill, two types of till (sandy till and clayey till) have been identified. The clayey till generally lies directly on the bedrock surface. It is quite dense, and has a lower hydraulic conductivity than the sandy till. Its areal extent is also more limited. The sandy till consists of unsorted sand and silt with varying amounts of clay and gravel. It generally extends to the ground surface in the hilly areas.

2.5.2 Type of Contamination and Affected Media

2.5.2.1 Groundwater Contamination

The nature and extent of groundwater contamination in the three aquifers in the OU-1 area (upper, lower, and bedrock) have been evaluated in detail through a Long-Term Monitoring Program (LTMP). To support the OU-1 LTMP an extensive network of interceptor, recovery and monitoring wells has developed over time (see **Figure 9**). Since the initial LTMP Round in 1986 twenty rounds of sampling and analysis within the OU-1 area have been completed (see **Table 2-1**). The purpose and scope of LTMP Rounds 1 through 11

varied from gathering the information necessary to develop, select and design the 1988 Remedial Action Plans; to assess the effectiveness of the 1988 soil removal actions; to assess the impact and effectiveness of original groundwater collection, treatment and recharge system; and to better define the nature and extent of contamination within OU-1.

Table 2-1: Schedule of Long-Term Monitoring Rounds										
Round No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Date (Mo./Yr.)	2/86	10/87	9/88	11/90	2/91	8/91	6/94	11/94	7/96	5/97
Round No.	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Date (Mo./Yr.)	5/98	5/99	11/99	11/00	11/01	11/02	11/03	11/04	11/05	11/06

LTMP Round 11, conducted in May 1998 by H&A was covered in detail in the 2000 FFS. The analytical results from Round 11 were used to develop total (and individual) VOC isopleth (plume) maps for the upper, lower and bedrock aquifers which document the approximate extent of groundwater in OU-1 at that time. Also during Round 11, OU-1 wide groundwater and surface water elevations were documented and isopleths (contour) maps were prepared for each of the three aquifers to document the capture zones of the groundwater collection system. Water levels were measured in 153 monitoring wells, four interceptor wells, 18 cleanouts and three pump stations installed in the groundwater collection system. The groundwater flow for the OU-1 area (based on groundwater elevation measurements collected during LTMP Round 11) is generally toward the northeast for all three aquifers. Therefore, the greatest likelihood of offsite migration is to the northeast towards the conservation lands owned by the Town of Bedford.

The above referenced plume and groundwater contour maps have been included as Appendix D of the 2007 Revised FFS. For a detailed description of the groundwater flow characteristics observed at the site, as well as a description of the nature and extent of OU-1 groundwater contamination in May 1998, please refer to the Field Investigation Report-Sampling Round 11 (H&A, 1998).

Following Round 11 the focus of the LTMP changed to gathering data necessary to support the selection of a final remedy; optimize the on-going remedial actions; and to monitor progress towards attainment of RAOs and the complete cleanup of OU-1. The most recent (2006) Long-Term Monitoring (LTM) Report for OU-1 has been included as Appendix C of the 2007 Revised FFS. The 2006 report, in conjunction with the other post-1998 LTM Reports, documents that contaminant levels are trending lower in each of the three aquifers throughout the OU-1 area. Levels of contaminants in OU-1's upper aquifer are below drinking water standards except for hotspots remaining in the immediate vicinity of the 3 source areas. Also at Site 3 levels of contaminants in the lower and bedrock aquifers continue to be below drinking water standards. In the off-site (conservation lands owned by the Town of Bedford) plume the TCE at the lower aquifer hotspot has been reduced from 1,000 ug/L in 1998 to 15 ug/L in 2006, and at the bedrock aquifer hotspot the TCE has been reduced from 50 ug/L in 1998 to 17 ug/L in 2006. **Table 2-2** lists all VOCs detections in the 2006 LTM round and also compares each to MCP and EPA Standards. These detections of VOCs in groundwater-surface water are also shown on **Figures 10** (upper/surface aquifer), **11** (lower/till aquifer) and **12** (bedrock aquifer).

TABLE 2-2
CONTAMINANTS OF CONCERN - OU-1
COMPARISON TO MCP AND EPA STANDARDS FOR CONSTITUENTS DETECTED IN GROUNDWATER AND SURFACE WATER
Operational Unit 1

Hanscom AFB
Bedford, Massachusetts

Volatile Organic Compounds

1,1,1-Trichloroethane
(71-55-6)

					Comparison to Standards (ppm)		
					EPA-MCL	MCP-GW1	MCP-GW2
Site Id	Date	Result	Units	Method	200	200	4000
B252	11/09/06	55.6	ug/l	8260B			
RAP1-3R	11/07/06	41600	ug/l	8260B	X	X	X

1,1-Dichloroethane
(75-34-3)

					Comparison to Standards (ppm)		
					EPA-MCL	MCP-GW1	MCP-GW2
Site Id	Date	Result	Units	Method	NA	70	1000
B108	11/09/06	4.82	ug/l	8260B			
B111	11/09/06	2.47	ug/l	8260B			
B122	11/10/06	2.49	ug/l	8260B			
B125	11/10/06	0.33F	ug/l	8260B			
B126	11/07/06	0.23F	ug/l	8260B			
B244A	11/07/06	0.65F	ug/l	8260B			
B245	11/07/06	0.4F	ug/l	8260B			
B248 [DUP]	11/09/06	1.2F	ug/l	8260B			
B248	11/09/06	1.05F	ug/l	8260B			
B251	11/09/06	0.11F	ug/l	8260B			
B252	11/09/06	10.5	ug/l	8260B			
B254 [DUP]	11/07/06	0.32F	ug/l	8260B			
B254	11/07/06	0.32F	ug/l	8260B			
P01-2R	11/07/06	0.15F	ug/l	8260B			
RAP1-6R [DUP]	11/07/06	82.2	ug/l	8260B		X	
RAP1-6R	11/07/06	56.7	ug/l	8260B			
RAP1-6S	11/07/06	0.46F	ug/l	8260B			
RAP1-6T	11/07/06	11.7	ug/l	8260B			
RAP2-1R	11/09/06	1.4F	ug/l	8260B			
RAP2-1T	11/09/06	2.3F	ug/l	8260B			
RAP2-3T	11/09/06	0.21F	ug/l	8260B			
RAP3-3T	11/10/06	4.13	ug/l	8260B			
RAP3-4S	11/10/06	2	ug/l	8260B			

1,1-Dichloroethene
(75-35-4)

					Comparison to Standards (ppm)		
					EPA-MCL	MCP-GW1	MCP-GW2
Site Id	Date	Result	Units	Method	7	7	80
B108	11/09/06	1.55F	ug/l	8260B			
B111	11/09/06	0.97F	ug/l	8260B			
B122	11/10/06	0.17F	ug/l	8260B			
B248 [DUP]	11/09/06	0.7F	ug/l	8260B			
B248	11/09/06	0.65F	ug/l	8260B			
B252	11/09/06	3.6	ug/l	8260B			
B254 [DUP]	11/07/06	0.19F	ug/l	8260B			
B254	11/07/06	0.16F	ug/l	8260B			
RAP1-6R [DUP]	11/07/06	7.4F	ug/l	8260B	X	X	
RAP1-6R	11/07/06	0.8F	ug/l	8260B			
RAP1-7R	11/07/06	1.6F	ug/l	8260B			
RAP2-1R	11/09/06	1.3F	ug/l	8260B			
RAP2-1T	11/09/06	1.4F	ug/l	8260B			

NOTES: 1) Current (April 3, 2006) MCP standards used for comparison.
2) X = Denotes exceedance of applicable standard
3) Source of this Table is "LTM Report for OU-1 - November 2006 Samples", prepared by Shaw E&I.

RAP2-3T	11/09/06	0.18F	ug/l	8260B
RAP3-3T	11/10/06	0.43F	ug/l	8260B
RAP3-4S	11/10/06	0.42F	ug/l	8260B

1,2-Dichlorobenzene
(95-50-1)

					Comparison to Standards (ppm)		
					EPA-MCL	MCP-GW1	MCP-GW2
Site Id	Date	Result	Units	Method	600	600	2000
RAP1-6T	11/07/06	0.1F	ug/l	8260B			

1,2-Dichloroethane
(107-06-2)

					Comparison to Standards (ppm)		
					EPA-MCL	MCP-GW1	MCP-GW2
Site Id	Date	Result	Units	Method	5	5	5
RAP1-6R [DUP]	11/07/06	5.8F	ug/l	8260B	X	X	X
RAP1-6R	11/07/06	4.85	ug/l	8260B			
RAP1-6T	11/07/06	0.35F	ug/l	8260B			

Acetone
(67-64-1)

					Comparison to Standards (ppm)		
					EPA-MCL	MCP-GW1	MCP-GW2
Site Id	Date	Result	Units	Method	NA	3000	50000
B125	11/10/06	3.33F	ug/l	8260B			
P01-2R	11/07/06	2.86F	ug/l	8260B			
RAP1-SW4	11/10/06	2.73F	ug/l	8260B			

Benzene
(71-43-2)

					Comparison to Standards (ppm)		
					EPA-MCL	MCP-GW1	MCP-GW2
Site Id	Date	Result	Units	Method	5	5	2000
B115 [DUP]	11/09/06	3.25F	ug/l	8260B			
B248 [DUP]	11/09/06	0.55F	ug/l	8260B			
B248	11/09/06	0.5F	ug/l	8260B			
B252	11/09/06	0.17F	ug/l	8260B			
B254 [DUP]	11/07/06	0.22F	ug/l	8260B			
B254	11/07/06	0.23F	ug/l	8260B			
RAP1-6R	11/07/06	0.7F	ug/l	8260B			
RAP1-6T	11/07/06	0.14F	ug/l	8260B			
RAP2-1R	11/09/06	1.1F	ug/l	8260B			
RAP2-1T	11/09/06	1F	ug/l	8260B			
RAP2-3T	11/09/06	0.12F	ug/l	8260B			
RAP3-3T	11/10/06	0.13F	ug/l	8260B			

Chloroform
(67-66-3)

					Comparison to Standards (ppm)		
					EPA-MCL	MCP-GW1	MCP-GW2
Site Id	Date	Result	Units	Method	100	5	400
RAP1-1T	11/07/06	0.59	ug/l	8260B			
RFW-11	11/09/06	0.66	ug/l	8260B			

Methyltert-butylether
(1634-04-4)

					Comparison to Standards (ppm)		
					EPA-MCL	MCP-GW1	MCP-GW2
Site Id	Date	Result	Units	Method	NA	70	50000
B251	11/09/06	0.44F	ug/l	8260B			

Toluene
(108-88-3)

					Comparison to Standards (ppm)		
					EPA-MCL	MCP-GW1	MCP-GW2
Site Id	Date	Result	Units	Method	1000	1000	8000
B115 [DUP]	11/09/06	39.2	ug/l	8260B			
B115	11/09/06	58	ug/l	8260B			
B232	11/10/06	0.17F	ug/l	8260B			
B252	11/09/06	0.9F	ug/l	8260B			
OW3-07	11/10/06	2.89	ug/l	8260B			
P01-2R	11/07/06	1.23	ug/l	8260B			
RAP1-3R	11/07/06	850F	ug/l	8260B			
RAP1-6S	11/07/06	0.56F	ug/l	8260B			

NOTES: 1) Current (April 3, 2006) MCP standards used for comparison.
2) X = Denotes exceedance of applicable standard
3) Source of this Table is "LTM Report for OU-1 - November 2006 Samples", prepared by Shaw E&I.

Trichloroethene

(79-01-6)

Site Id	Date	Result	Units	Method	Comparison to Standards (ppm) EPA-MCL 5	MCP-GW1 5	MCP-GW2 30
B108	11/09/06	18.5J	ug/l	8260B	X	X	
B111	11/09/06	7.42J	ug/l	8260B	X	X	
B115 [DUP]	11/09/06	4.75F	ug/l	8260B			
B118	11/10/06	0.48F	ug/l	8260B			
B122	11/10/06	0.55F	ug/l	8260B			
B125	11/10/06	0.28F	ug/l	8260B			
B126	11/07/06	12.9J	ug/l	8260B	X	X	
B244A	11/07/06	16.4J	ug/l	8260B	X	X	
B245	11/07/06	4.62J	ug/l	8260B			
B248 [DUP]	11/09/06	15.2J	ug/l	8260B	X	X	
B248	11/09/06	12.8J	ug/l	8260B	X	X	
B249	11/09/06	1.43J	ug/l	8260B			
B251	11/09/06	1.68J	ug/l	8260B			
B254 [DUP]	11/07/06	8.86J	ug/l	8260B	X	X	
B254	11/07/06	8.78J	ug/l	8260B	X	X	
OW3-07	11/10/06	0.26F	ug/l	8260B			
P01-2R	11/07/06	5.34J	ug/l	8260B	X	X	
RAP1-1R	11/07/06	0.22F	ug/l	8260B			
RAP1-1T	11/07/06	0.46F	ug/l	8260B			
RAP1-3R	11/07/06	142000J	ug/l	8260B	X	X	X
RAP1-4RA	11/07/06	1.26J	ug/l	8260B			
RAP1-6R [DUP]	11/07/06	71.8J	ug/l	8260B	X	X	X
RAP1-6R	11/07/06	19.3J	ug/l	8260B	X	X	
RAP1-6S	11/07/06	0.32F	ug/l	8260B			
RAP1-6T	11/07/06	1.44J	ug/l	8260B			
RAP1-7R	11/07/06	256J	ug/l	8260B	X	X	X
RAP1-7T	11/07/06	12.6J	ug/l	8260B	X	X	
RAP1-SW4	11/10/06	0.64F	ug/l	8260B			
RAP2-1R	11/09/06	130J	ug/l	8260B	X	X	X
RAP2-1T	11/09/06	3.9F	ug/l	8260B			
RAP2-3T	11/09/06	1.88J	ug/l	8260B			
RAP3-3S	11/10/06	62.6J	ug/l	8260B	X	X	X
RAP3-3T	11/10/06	0.86F	ug/l	8260B			
RAP3-4S	11/10/06	3.86J	ug/l	8260B			
RFW-11	11/09/06	6.3J	ug/l	8260B	X	X	

Vinyl chloride

(75-01-4)

Site Id	Date	Result	Units	Method	Comparison to Standards (ppm) EPA-MCL 2	MCP-GW1 2	MCP-GW2 2
B108	11/09/06	11.3	ug/l	8260B	X	X	X
B111	11/09/06	2.28	ug/l	8260B	X	X	X
B115 [DUP]	11/09/06	74.8	ug/l	8260B	X	X	X
B115	11/09/06	110	ug/l	8260B	X	X	X
B244A	11/07/06	2.7F	ug/l	8260B	X	X	X
P01-2R	11/07/06	0.44F	ug/l	8260B			
RAP1-6R [DUP]	11/07/06	184	ug/l	8260B	X	X	X
RAP1-6R	11/07/06	85	ug/l	8260B	X	X	X
RAP1-6S	11/07/06	4.17	ug/l	8260B	X	X	X
RAP1-6T	11/07/06	5.83	ug/l	8260B	X	X	X
RAP2-1T	11/09/06	3.6F	ug/l	8260B	X	X	X
RAP3-4S	11/10/06	0.92F	ug/l	8260B			

NOTES: 1) Current (April 3, 2006) MCP standards used for comparison.
2) X = Denotes exceedance of applicable standard
3) Source of this Table is "LTM Report for OU-1 - November 2006 Samples", prepared by Shaw E&I.

cis-1,2-Dichloroethene

(156-59-2)

Site Id	Date	Result	Units	Method	Comparison to Standards (ppm) EPA-MCL 70	MCP-GW1 70	MCP-GW2 100
B108	11/09/06	101M	ug/l	8260B	X	X	X
B111	11/09/06	102M	ug/l	8260B	X	X	X
B115 [DUP]	11/09/06	1300M	ug/l	8260B	X	X	X
B115	11/09/06	1100M	ug/l	8260B	X	X	X
B118	11/10/06	2.57M	ug/l	8260B			
B122	11/10/06	3.57M	ug/l	8260B			
B125	11/10/06	0.85M	ug/l	8260B			
B126	11/07/06	6.21M	ug/l	8260B			
B244A	11/07/06	50.2M	ug/l	8260B			
B245	11/07/06	35.1M	ug/l	8260B			
B248 [DUP]	11/09/06	120M	ug/l	8260B	X	X	X
B248	11/09/06	120M	ug/l	8260B	X	X	X
B249	11/09/06	0.2M	ug/l	8260B			
B251	11/09/06	4.56M	ug/l	8260B			
B254 [DUP]	11/07/06	25.3M	ug/l	8260B			
B254	11/07/06	25.2M	ug/l	8260B			
OW3-07	11/10/06	0.82M	ug/l	8260B			
P01-2R	11/07/06	0.88M	ug/l	8260B			
RAP1-3R	11/07/06	45000M	ug/l	8260B	X	X	X
RAP1-4RA	11/07/06	0.77M	ug/l	8260B			
RAP1-6R [DUP]	11/07/06	479M	ug/l	8260B	X	X	X
RAP1-6R	11/07/06	71M	ug/l	8260B	X	X	
RAP1-6S	11/07/06	9.91M	ug/l	8260B			
RAP1-6T	11/07/06	2.72M	ug/l	8260B			
RAP1-7R	11/07/06	17.3M	ug/l	8260B			
RAP1-7T	11/07/06	1.78M	ug/l	8260B			
RAP1-SW4	11/10/06	2.03	ug/l	8260B			
RAP2-1R	11/09/06	160M	ug/l	8260B	X	X	X
RAP2-1T	11/09/06	257M	ug/l	8260B	X	X	X
RAP2-3T	11/09/06	35.7M	ug/l	8260B			
RAP3-3S	11/10/06	7.85M	ug/l	8260B			
RAP3-3T	11/10/06	9.91M	ug/l	8260B			
RAP3-4S	11/10/06	106M	ug/l	8260B	X	X	X
RFW-11	11/09/06	0.6M	ug/l	8260B			

trans-1,2-Dichloroethene

(156-60-5)

Site Id	Date	Result	Units	Method	Comparison to Standards (ppm) EPA-MCL 100	MCP-GW1 100	MCP-GW2 90
B108	11/09/06	0.525F	ug/l	8260B			
B111	11/09/06	0.35F	ug/l	8260B			
B115 [DUP]	11/09/06	5F	ug/l	8260B			
B244A	11/07/06	1.95F	ug/l	8260B			
B248 [DUP]	11/09/06	1.15F	ug/l	8260B			
B248	11/09/06	1.05F	ug/l	8260B			
RAP1-6R [DUP]	11/07/06	8.6F	ug/l	8260B			
RAP1-6R	11/07/06	6.25	ug/l	8260B			
RAP1-6S	11/07/06	0.16F	ug/l	8260B			
RAP1-6T	11/07/06	0.95F	ug/l	8260B			
RAP2-1R	11/09/06	1.5F	ug/l	8260B			
RAP2-1T	11/09/06	2F	ug/l	8260B			
RAP2-3T	11/09/06	0.27F	ug/l	8260B			
RAP3-4S	11/10/06	1.32F	ug/l	8260B			

NOTES: 1) Current (April 3, 2006) MCP standards used for comparison.
2) X = Denotes exceedance of applicable standard
3) Source of this Table is "LTM Report for OU-1 - November 2006 Samples", prepared by Shaw E&I.

2.5.2.2 Soils

As noted earlier in this ROD, extensive response actions were undertaken by the USAF at OU-1 Sites 1, 2, and 3 in the late 1980s. These actions were intended to remove buried containers and/or visually contaminated soils at these three source areas. Excavation areas are depicted in **Figures 2, 3,** and **4.** Also Land Use Controls (LUCs)/Institutional Controls (ICs) will be maintained and enforced to control direct contact with any residual soil contamination at IRP Sites 1, 2 and 3.

Also, as discussed in Section 2.2.2, Hanscom AFB partnered with EPA and Tufts University on a soil sampling program in 1996. The program was specifically designed to determine if residual soil contamination presents a potential human health risk, either through leaching to groundwater or through construction worker direct contact. The data was also used to evaluate to what extent the response efforts to date have been effective in reducing soil contamination in the source areas, and in assessing whether the source areas warrant any further remediation. COCs detected during the 1996 investigation above MCP S-1, GW-1 standards included trichloroethene (0.03 – 2,100 mg/Kg), cis-1,2-dichloroethene (0.005 – 160 mg/kg), 1,2–dichloroethane (0.03 – 0.12 mg/Kg), tetrachloroethene (0.02 – 0.54), and toluene (0.02 – 280 mg/Kg). The data from this 1996 soil sampling program was also used by CH2M Hill to evaluate the soil-to-groundwater contaminant transport pathway at confirmed OU-1 plume source areas. See section 2.7.1.1, Potential Risks from Soil Contamination, below for the results of this evaluation.

2.5.2.3 Surface Water

The surface water in the drainage channel east of Runway 5-23, which discharges into the wetlands/beaver ponded area north of Hanscom Field, has been analyzed for VOCs in each of the LTMP rounds. Levels of VOCs in the surface water, which were significantly greater than drinking water standards (MCLs) prior to the commencement of remedial actions, have declined significantly since remedial efforts began. Since 1996 the total VOC concentrations in this drainage channel have been below these standards. Also, in Round 9 (1996) through Round 14 (2000), surface water sampling was expanded to include samples from the wetlands/beaver ponded area north of Hanscom Field and to include the analysis for selected trace metals (cadmium, copper, lead, and zinc). In general, recent surface water sampling has shown the presence of some low concentrations of VOCs and metals. Refer to Section 2.7, Summary of Site Risks, below for risk characterization information and to **Figure 13** for surface water sampling locations.

2.5.2.4 Drainage Channel and Wetland Sediments

LTMP Round 9 (1996) through Round 14 (2000) also included the sampling and analysis of sediments within the drainage channel east of Runway 5-23 and the wetlands/beaver ponded area north of Hanscom Field. These sediment samples were analyzed for VOC, selected metals (cadmium, copper, lead and zinc), and total organic carbon. The results of the sediment analysis, as well as the surface water analysis, were used to evaluate ecological risks in the wetlands/beaver ponded area. Sediment analyses indicated the presence of some VOCs in addition to copper, lead, and zinc. Refer to the Risk Assessment section below for characterization of risk information and to **Figure 13** for sediment sampling locations.

2.5.3 The Conceptual Site Model

The conceptual site model (CSM) is a three-dimensional "picture" of site conditions that illustrates contaminant sources, release mechanisms, exposure pathways/migration routes, and potential human and ecological receptors. The CSM documents current and potential future site conditions and shows what is known about human and environmental exposure from contaminant release and migration to potential receptors. The risk assessment and response actions for the contaminants at OU-1 are based on the CSM. **Figures 14** and **15** present the CSMs for the OU-1 human and ecological risk assessment.

2.5.3.1 Site Overview

OU-1 is an area with groundwater contamination that includes three distinct areas of concern, known as IRP Sites 1, 2, and 3, which are all located on Hanscom Field, a full service general Aviation airport owned by the Commonwealth of Massachusetts, for which the Air Force is the principal responsible party. These sites (1, 2 and 3) are confirmed plume source areas which may still have some residual soil contamination. In addition to Hanscom Field, OU-1 also includes wetlands and a beaver ponded area to the north/northeast of the airfield which is owned by the Town of Bedford, and a small part of Hanscom AFB which is used as a campground and the site of the central groundwater treatment system. OU-1 lies on a relatively flat plateau that is bordered by low, rounded hills on the north, west, and the south. OU-1 also includes a northeast tending drainage channel which flows into the wetlands. This drainage channel also receives the OU-1 groundwater treatment system's effluent.

The wetlands north/northeast of the airfield were identified in the Final *Ecological Risk Assessment Methodology and Problem Formulation* as the primary ecological habitat area within the OU-1 area. This forested wetland with a tributary of the Shawsheen River was delineated and named Wetland B during the Comprehensive Ecological Analysis in 1992-1995 conducted by LEC Environmental Consultants for Hanscom AFB. After the investigations of Wetland B in 1995, beaver dammed the drainage channel resulting in a significant portion of the former wetland becoming inundated. Therefore, the name "Wetland B/beaver pond" was adopted to represent this mixed habitat.

2.5.3.2 Exposure Pathways

Site groundwater is the current contaminant source with migration of the contaminants through groundwater flow (which is influenced by the groundwater collection, treatment and recharge system). There is also the potential for any residual contaminants in the subsurface soils to be transported to the groundwater through infiltration, percolation, and/or leaching. Since the surface soil contamination was removed as part of previous remedial activities at the site, there is no ground surface exposure pathway, and no migration through surface run-off. However, there is the potential that historic surface run-off resulted in contaminant migration to sediments in Wetland B/beaver pond. The high organic content of wetland sediments can bind and hold contamination in place for a considerable amount of time. In addition, since groundwater is expected to discharge into the Wetland B/beaver pond area, there exists a potential for contamination to occur in the sediment and surface water as the groundwater flows into these media.

2.6 Current and Potential Future Site and Resource Uses

The majority of OU-1 consists of L.G. Hanscom Field, owned by the Commonwealth of Massachusetts, and used as a full service General Aviation (GA) airport operated by Massport and the FAA. Discussions with Massport's Hanscom Field officials and review of recent newspaper articles and Massport's 2005 L.G. Hanscom Field Environmental Status & Planning Report (ESPR)(includes 2010 and 2020 scenarios) substantiate that this area will continue to be used for civilian and commercial aviation purposes for the foreseeable future. As stated in the ESPR "The retrospective and prospective information presented in the ESPR allows it to be used as a planning tool for assessing and reviewing changes at Hanscom Field and its environs over time."

There is also a small section of OU-1 which is leased from the state by Hanscom AFB and is used as a campground and as the site of the central groundwater treatment facility for OU-1. The most recent Hanscom AFB General Plan (master plan) Update (November 2003) identifies the campground area as "Outdoor Recreation" or "Open Space" in both the existing and future Land Use Plans and in both plans the treatment facility area is listed as "Industrial". Potable water for the campground and treatment facility is provided by the Town of Bedford public water supply distribution system. The General Plan Update also shows each of the 3 IRP Sites on Hanscom Field and the parcel leased by Hanscom AFB as areas with "Environmental Constraints" and also with "Operational Constraints".

OU-1 also extends into undeveloped wetlands with beaver ponded areas and forest areas owned by the Town of Bedford and known as the Jordan Conservation Area and Hartwell Town Forest. There are deed restrictions on these lands which limit use to passive and/or active recreation use.

Groundwater beneath and directly downgradient to OU-1 is not currently used as a drinking water supply, and it is not expected to be so used in the future. Nonetheless, the groundwater beneath and directly downgradient to OU-1, and beneath and directly downgradient to the Hanscom AFB/Hanscom Field NPL Site as a whole, has been designated as GW-1 (i.e., as a potential future drinking water supply) under state law by means of a Town of Bedford Aquifer Protection District by-law that was enacted through a process authorized by and implementing the MCP. In addition, MADEP has classified the eastern side of OU-1, east of Runway 5-23, as an approved Zone II; under the state drinking water regulations (310 CMR 22.02), a Zone II is "that area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated." Further in addition, the northeastern portion of the site at the northern end of Runway 5-23 is classified as a Potentially Productive Aquifer; the MCP defines "Potentially Productive Aquifer" in part as "all aquifers delineated by the U.S. Geological Survey (USGS) as a high or medium yield aquifer." As a result, MADEP has classified groundwater in this area as Class I "high use and value." The MADEP Site Scoring Map is included as **Figure 16**.

2.7 Summary of Site Risks

2.7.1 Human Health Risk Assessment

2.7.1.1 Potential Risks from Groundwater Contamination

Based on agreement between USEPA Region I, MADEP and Hanscom AFB, a full baseline human health risk assessment was not conducted for OU-1. It was determined that COC concentrations in OU-1 groundwater exceed federal drinking water standards (i.e., MCLs and non-zero MCLGs), state drinking water standards (i.e., MCLs) and state groundwater risk characterization standards (i.e., MCP Method 1 GW-1 standards) at many locations, and that as a result there is an unacceptable risk to human health from groundwater ingestion.

2.7.1.2 Potential Risks from Soil Contamination

It was concluded by Hanscom AFB, USEPA and MADEP that the risk associated with soil contamination at OU-1 was related to the potential for continued degradation of the quality of groundwater below OU-1. Construction worker direct contact exposure was not assessed as construction activities other than those associated with remedial efforts are not envisioned at these IRP sites on an active airfield. These areas are immediately adjacent to the runways, within the restrictive airfield area, and the only potential construction would be for utility services or associated with the remedial efforts (which would include a site-specific health and safety plan in accordance with OSHA (29 CFR 1910.120) and all other applicable federal, state, and local requirements). Also LUCs/ICs will be maintained and enforced to control direct contact with any residual soil contamination at IRP Sites 1, 2 and 3. Further, in place remedial system piping and recharge basins at Site 2 and 3 would necessitate routing of utility services around the area which may have residual subsurface soil contamination. If construction activities are planned for the airfield area in the future, appropriate health and safety procedures will be followed, including the preparation of a site specific health and safety plan, in accordance with OSHA (29 CFR 1910.120) and all other applicable federal, state, and local requirements.

In order to assess the potential for continued degradation of groundwater quality from infiltration through soils within the OU-1 area, a soil-to-groundwater pathway analysis was conducted and presented in the 2000 FFS Study. The objective of this evaluation was to determine if additional remedial efforts were required to reduce or remove contaminants from the soils above the water table that are leaching into the groundwater.

The use of the soil-to-groundwater pathway analysis for evaluating potential human health concerns associated with OU-1 soil was discussed with and agreed to by USEPA Region 1 prior to implementation. USEPA approved methodology was used to estimate potential groundwater concentrations based on available soil data. Data from the 1996 soil sampling at Sites 1, 2, and 3 discussed earlier were used in this evaluation.

Soil data were evaluated to estimate the potential groundwater concentration associated with the measured soil concentrations. The predicted groundwater concentrations were then compared with MCLs, which are federal and state drinking water standards. If an MCL was not available for a constituent detected in soil, the predicted groundwater concentration was compared with the MCP Method 1 GW-1 groundwater standard (310

CMR 40.0000). The predicted groundwater concentrations also were compared with groundwater concentrations measured in wells located within or downgradient from the three plume source areas in OU-1. Calculated groundwater concentrations exceeding USEPA MCLs based on the 1996 soil data are presented in **Table 2-3**. Please note the soil borings for this evaluation are shown on **Figures 2, 3** and **4** for Sites 1, 2 and 3 respectively.

The results of the soil to groundwater modeling, evaluation of the LTMP groundwater monitoring data, and comparisons with MCLs indicate that potential leaching from soil to groundwater may occur in some isolated areas of Sites 1 and 2 and to a much lesser extent at Site 3. The areas with the highest concentrations that may present a leaching concern are limited in size both laterally and vertically (i.e., within the soil column).

In general, the majority of estimated contaminant concentrations in groundwater based on the mean concentration for each site are below the corresponding drinking water standards. In many cases the estimated concentrations calculated using the maximum soil concentrations also are below these standards. A closer review of the soil data shows that the soil concentrations that do lead to an estimated groundwater concentration in exceedance of the drinking water standards are located in a limited area of the soil. For the most part, the estimated groundwater concentrations are similar to or greater than the concentrations measured during the LTMP in the surficial aquifer monitoring wells within or downgradient of the OU-1 Sites. Some of the constituents that were detected in soil samples have not been detected in groundwater. Conversely, some of the constituents that have been detected in groundwater were not detected in soil.

Considering the results of the soil to groundwater evaluation, as well as the extensive groundwater data generated during the LTMP, it can be concluded that it is unlikely that residual levels of VOCs in soils at Sites 1, 2, and 3 are contributing significantly to the groundwater contamination identified in each of the areas. Furthermore, the locations where there is increased potential that VOCs in soils may be leaching to groundwater are highly localized and are limited the actual Burn Pits (#1 and #2) and the Burn Pit 1 Runoff Area at IRP Site 1 and the drum burial pits at IRP Sites 2 and 3). At Site 1 the area of Burn Pit #1 that was excavated in 1988 was approximately 450 square yards (sy); at Burn Pit #2 the excavated area was approximately 400 sy; and the runoff area that was excavated was approximately 650 sy. At Site 2 there were 4 drum burial pits excavated in 1988 whose size varied from 100 sy to 200 sy and at Site 3 there were approximately 10 drum burial pits in 1988 whose size varied from 100 sy to 350 sy. It should be noted that the locations of the soil borings that had concentrations of VOCs in 1996 are located within the capture zones of the groundwater collection trenches at Sites 1, 2 and 3. Also note that 10+ years of has now elapsed since the soil data was collected. The levels of any residual VOCs in the soils should have been reduced by the continued flushing (natural and treated water recharged) of these soils during the past 10+ years. In viewing the data set as a whole at each site, it is apparent that the VOC detections that may still pose a concern are not a widespread problem. Also note that the selected remedy addresses source area soils by land use controls/institutional controls to ensure that future land use does not increase the risk of exposure to residual soil contamination in the plume source areas.

Table 2-3: Calculated Groundwater Concentrations exceeding EPA MCLs based on 1996 Soil Data

		Site 1			Site 2			Site 3A			Site 3B		
Compound	EPA MCL (mg/L)	Maximum[a] (mg/L)	Mean[b] (mg/L)	Median[c] (mg/L)	Maximum[a] (mg/L)	Mean[b] (mg/L)	Median[c] (mg/L)	Maximum[a] (mg/L)	Mean[b] (mg/L)	Median[c] (mg/L)	Maximum[a] (mg/L)	Mean[b] (mg/L)	Median[c] (mg/L)
1,2-Dichloroethane	0.005	0.010	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzene	0.005	NA	NA	NA	0.022	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	0.07	10.5	0.295	NA	0.202	NA	NA	NA	NA	NA	0.080	NA	NA
Tetrachloroethene	0.005	0.021	NA	NA	0.016	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene	0.1	0.182	NA	NA	0.104	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	0.005	0.276	0.011	NA	6.42	0.207	NA	NA	NA	NA	NA	NA	NA
Methylene Chloride*	0.005	NA	NA	NA	7.73	0.169	NA	0.029	0.021	NA	NA	NA	NA
m/p-Xylene	10	NA	NA	NA	NA	NA	NA	11.1	NA	NA	NA	NA	NA
Toluene	1	NA	NA	NA	NA	NA	NA	17.5	NA	NA	NA	NA	NA

Note: Groundwater concentrations were calculated using a soil to groundwater pathway model based upon existing residual soil contamination in 1996.

[a] Calculated using maximum detected soil concentrations

[b] Calculated using mean of all soil concentrations

[c] Calculated using the median of all soil concentrations

NA = not applicable, calculated groundwater concentration below MCLs

* Potential laboratory contaminant

2.7.1.3 Potential Risks Vapor Intrusion into Indoor Air

EPA's draft guidance issued to help determine if the vapor intrusion exposure pathway poses a significant risk to human health has been reviewed and determined not to be applicable to OU-1 at this time because of the following:

- There are no permanent residential settings within the footprint of the OU-1 groundwater that has VOC contamination in any of the three aquifers of concern.

- Receptors in sections of OU-1 where vapor intrusion could pose a risk are primarily limited to site workers (the remedial action contractor's on-site operation, maintenance, and monitoring staff) and periodic/short-term official visitors. Also the OU-1 groundwater treatment system and office/break trailer for the site workers are located on the upgradient side of the Site 1 plume in the lower and bedrock aquifers. There was no soil and/or groundwater contamination found in this area during the pre-NPL investigations conducted to support/develop the 1988 RAPs for IRP Sites 1, 2 and 3. As noted in Section 2.6 the Hanscom AFB November 2003 General Plan Update identifies the area of the treatment facility as "Industrial" in both the existing and future Land Use Plans. OSHA (29 CFR 1910.120) requires that a Site Specific Health and Safety Plan and properly trained workers (hazardous waste operations and emergency response - initial 40-hours/annual 8-hour refresher). The Site Specific Health and Safety Plan for the on-going remedial action includes hazard communication and medical monitoring of the site workers. Also from the 1991 through 1998 there were periodic personal exposure monitoring of routine operations to demonstrate compliance with standards for workplace exposure to chemical hazards. This monitoring consistently demonstrated negligible personal exposure for routine plant operations and maintenance tasks.

- The exposure pathway to potential receptors in the Hanscom AFB Campground area and conservation lands owned by the Town of Bedford is not complete; i.e., LTMP data confirms that, with the exception of immediate vicinity of the Site 1 and Site 2 source areas which are limited/restricted in extent, the surficial aquifer has been cleaned up and VOC contaminated groundwater is confined in to the lower and bedrock aquifers by the overlying lacustrine layer and surface aquifer.

- In 2002 the Second Five-Year Review concluded that LTMP data indicated that the surficial aquifer in the Hanscom AFB Campground area and conservation lands owned by the Town of Bedford has been cleaned up to meet drinking water standards (MCLs) and the monitoring of the surface aquifer in these sections of OU-1 was suspended. The surface aquifer monitoring wells in the Campground area include B101, B107, RAP2-1S, RAP2-2S and RAP 2-3S. The monitoring wells used to evaluate the surface aquifer in the conservation lands include B102, B127, B128, B129, B246, B247, B250, and B253. The following summarizes the results of the most recent/last laboratory analysis of samples collected from these wells. Subsequent to their last laboratory analysis these wells remained in Phase 2 of the LTMP through October 2002. This screening of samples using the on-site GC continued to find levels of TCE and/or cis-1,2-DCE below the instruments MDL, usually with both compounds reported as undetected.

Hanscom AFB Campground area

- B101 – July 1996 – no reported VOC detection except for a qualified (estimated) detection of TCE (0.62j ug/L)
- B107 – May 1998 - no reported VOC detection except for TCE (2.8 ug/L)
- RAP2-1S – May 1998 - no reported VOC detection except for chloroform (3.2 ug/L)
- RAP2-2S – July 1996 – no reported VOC detection except for TCE (0.74 ug/L) and 1,2-DCE (total) (0.56 ug/L) – analysis of field duplicate had no reported VOC detection except for TCE (1.3 ug/L)
- RAP2-3S – July 1996 – no reported VOC detection

Conservation Lands

- B102 & B127 – May 1998 - no reported VOC detection
- B128 – November 2002 - no reported VOC detection except for TCE (0.40 ug/L) and cis-1,2-DCE (0.36 ug/L)
- B129 – November 2002 - no reported VOC detection except for cis-1,2-DCE (3.53 ug/L) and qualified (estimated) detections of Benzene (0.4F ug/L) and vinyl chloride (0.61F ug/L)
- B246, B247, B250 & B253 – November 2002 - no reported VOC detection

Also note that LUCs/ICs will be enforced to ensure that this exposure route is re-evaluated during the planning phase of any proposed construction in the OU-1 area.

2.7.2 Ecological Risk Assessment

An Ecological Risk Assessment (ERA) was conducted to identify the risk that "chemicals of potential concern" (COPCs) may have upon ecological receptors in the vicinity of OU-1 (CH2M Hill, 1999).

This ERA used a phased approach, which consisted of:

- Problem Formulation
- Identification of Contaminants of Potential Concern
- Risk Questions
- Exposure and Effects Scenarios
- Risk Characterization

The area north of the airfield was identified in the Final *Ecological Risk Assessment Methodology and Problem Formulation* as the primary ecological habitat area within the OU-1 area. This forested wetland was delineated and named Wetland B in 1992-1995 Comprehensive Ecological Analysis for Hanscom AFB conducted by LEC Environmental Consultants. After the investigations of Wetland B in 1995, beaver dammed the drainage channel resulting in a significant portion of the former wetland becoming inundated. Therefore, the name "Wetland B/beaver pond" was adopted to represent this mixed habitat. The ERA was based upon results of Round 9 and Round 11 sampling by H&A within the Wetland B/beaver pond area. A screening analysis of surface water and sediment samples

and, where necessary, a site-specific assessment of risk, were completed for the receptors in surface water, sediment, and the beaver pond.

2.7.2.2 Identification of Contaminants of Potential Concern

Chemicals of potential concern (COPCs) were identified using a series of steps. These steps involved identification of conservative ecological screening thresholds (concentrations of compounds shown in the literature to cause adverse ecological effects relevant to the appropriate assessment endpoint) for each medium and comparison of maximum media concentrations of detected contaminants to the screening thresholds through the use of hazard quotients (HQs), the ratio of media concentrations to screening thresholds). COPCs evaluated in the OU-1 ERA are presented by media in **Tables 2-4** and **2-5**.

This screening process resulted in the elimination of most COPCs for each of the receptor groups. Lead and copper were identified as COPCs for sediment-dwelling organisms. Lead in surface water was identified as a COPC for both surface water organisms and semi-aquatic organisms such as the beaver. The HQ for cadmium in surface water was only slightly above 1.0 and was only detected in one of five samples; therefore, cadmium was not included as a COPC and was not investigated further. Volatile organic compounds (VOCs) were not identified as COPCs for either sediment or surface water organisms. The exposure of beaver to inhalation of VOCs within their dens, however, was evaluated for possible effects on beaver, because of the nature of the confined space inside the dens where VOCs can accumulate.

2.7.2.3 Exposure and Effects Scenarios

The Exposure and Effects Scenarios phase of the ERA was performed for each COPC and, with regard to the potential for inhalation by beaver only, for VOCs.. This entailed determining whether and how receptor groups are exposed to COPCs and VOCs and then characterizing the possible adverse effects for contaminant levels exceeding published toxic levels. Exposure pathways identified during the OU-1 ERA are presented below in **Table 2-6**. To evaluate further the potential effects of lead on beaver, a model was created to determine the average daily lead and copper exposure to the beaver. An inhalation model also was created to determine the average daily dose of VOCs to beaver.

2.7.2.4 Ecological Risk Characterization

In the Risk Characterization phase of the ERA, exposure concentrations determined from the exposure models were compared to values documented to cause adverse effects. The Screening Toxicity Values used in this process are presented for each contaminant in **Tables 2-4** and **2-5**.

Table 2- 4
Ecological Risk Assessment
Occurrence, Distribution, and Selection of Chemicals of Concern (COC)

Exposure Medium: Sediment								
Chemical of Potential Concern	Min Conc (ppb)	Max. Conc (ppb)	Ave. Conc (ppb)	Location Maximum Detection	Lower Threshold Value (ppb)	Threshold Value Source	HQ Value[1]	COC Flag Y or N
Chloromethane	-	5.0	3.0	SS202	-		NA	N
Acetone	-	240.0	123.8	SS203	1623	H&S	0.15	N
1,2-Dicholoroethene (total)	-	28.0	10.5	SS203	150000	D	0.0002	N
2- Butanone	-	100.0	52.2	SS203	270	ORNL	0.37	N
Trichloroethene	-	22.0	7.1	SS203	220	ORNL	0.10	N
Toluene	-	560.0	247.0	SS205	19933	H&S	0.03	N
Ethylbenzene	-	10.0	4.1	SS202	110570	H&S	0.0001	N
Copper	-	25000	16400	SS202&3	16000	P	1560	Y
Lead	-	100000	61800	SS204	31000	P	3230	Y
Zinc	-	47000	33400	SS204	120000	P	390	N

Key:
Conc = Concentration
- = Not Available
Averages were calculated using one-half the detection limit for non-detects
Although not detected, one-half of cadmium's detection limits exceed the lower screening benchmark.
H&S = Hull & Suter, 1994. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment Associated Biota: 1994 Revision.
P = Persuad et al. 1994. Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario. Ontario Ministry of the Environment.
D = USDOE, 1994. Loring AFB Risk Assessment Methodology. US Department of Energy. DE/AC05/840R21400.
ORNL = ORNL, 1997. Oak ridge National Laboratory, Equilibrium partitioning-derived sediment quality benchmarks, based on conventional aqueous benchmarks presented in Suter and Tsao (1996).

Notes:
1 Hazard Quotient (HQ) is defined as Maximum Concentration/ Screening Toxicity Value.

Table 2-5
Ecological Risk Assessment
Occurrence, Distribution, and Selection of Chemicals of Concern (COC)

Exposure Medium: Surface Water

Chemical of Potential Concern	Min. Conc (ppm)	Max. Conc (ppm)	Ave. Conc (ppm)	Location Maximum Detection (ppm)	Chronic Screening Toxicity Value[2] (ppm)	Chronic Screening Toxicity Value Source	HQ Value[1]	COC Flag Y or N
Chloromethane	-	1.4	0.68	RAP1-SW11	NA	NA	NA	N
Acetone	-	10	6.25	Sw202	1500	S&M	0.01	N
1,2-Dichloroethene (total)	-	3.8	1.38	RAP1-SW4	590	S&M	0.01	N
2- Butanone	-	10	6.25	Sw202	14000	S&M	0.00	N
Trichloroethene	-	4	1.40	RAP1-SW4	47	S&M	0.09	N
Toluene	-	8.5	2.12	Sw202	10	S&M	0.85	N
Cadmium	-	1.4	0.68	Sw201	1.2	EPA	1.17	Y
Copper	-	36	15.30	Sw202	13.8	EPA	2.61	Y
Lead	-	59	27.72	Sw201	3	EPA	19.7	Y
Zinc	-	64	38.60	Sw201	121	EPA	0.53	N

Key:
Conc = Concentration
- = Not Available
S&M = Suter and Mabrey, 1996. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Aquatic Biota: 1996 Revision.
EPA = EPA (NAWQC, 40 CFR 131-36)
Notes:
1 Hazard Quotient (HQ) is defined as Maximum Concentration/ Screening Toxicity Value.
2 Maximum Screening Benchmark for VOCs are Tier II values (Suter and Mabrey, 1996); values for metals are the freshwater National Ambient Water Quality Criteria (NAWQC) derived using the hardness at the location of maximum concentration.

Table 2-6
Ecological Exposure Pathways of Concern

Exposure Medium	Sensitive Environment Flag Y or N	Receptor	Endangered /Threatened Species Flag Y or N	Exposure Routes	Assessment Endpoints	Measurement Endpoints
Sediment	Y	Benthic organisms	N	Absorption and ingestion of chemicals in sediment	Abundance and diversity	Concentrations below sediment quality thresholds, which have been documented to be protective of sediment dwelling organisms.
		Beaver Community	N	Ingestion of chemicals in sediment	Beaver survival and recruitment	Concentrations below toxic inhalations and dietary dose thresholds, which have been documented to be protective of beaver.
Surface Water	Y	Aquatic Organism	N	Absorption and ingestion of surface water.	Growth and survival of water column populations	Concentrations below water quality thresholds, which have been documented to be protective of organisms inhabiting the water column.
		Beaver Community	N	Normal daily ingestion of surface water.	Beaver survival and recruitment	Concentrations below toxic inhalations and dietary dose thresholds, which have been documented to be protective of beaver.

Several points of uncertainty were associated with the models used in exposure assessment for beavers. In addition, it should be recognized that other potential sources exist for the lead present in the beaver pond surface water.

Based on the phased approach of this ERA, the following conclusions were drawn:

1. There is no risk to benthic organisms (e.g., chirnomids- midge larvae, tricoptera- caddis fly larvae) within OU-1 from either metals or VOCs in sediment.
2. There is no risk to aquatic dwelling organisms (e.g., fish, tadpoles) within OU-1 from VOCs.
3. Risk to individual aquatic organisms (e.g., fish, tadpoles) from lead is possible due to exceedance of National Ambient Water Quality Criterion (NAWQC); however, given the high variability of the data, area of exceedance, and ecological observations of the system, there does not appear to be an unacceptable risk at the population or community level. There is, however, considerable uncertainty in this conclusion which stems from the following factors:
    - Concentrations varied across the Wetland B/beaver pond.
    - Hardness (carbonates in the water as measured by calcium carbonate content) between sites varied with the maximum being seven times higher than the minimum. This resulted in varying NAWQC values.
    - No concentrations were above acute NAWQC.
4. There is no risk to beaver at OU-1 from either metals or VOCs.

To address these areas of uncertainty and the possibility that sediment may be the source contributing to the elevated concentrations of lead and copper, two additional rounds of sampling were recommended to be performed in Wetland B/beaver pond as part of the selected interim remedial action for the OU-1 area. During each round, a total of three samples were to be collected from three locations: upgradient, the area of highest concentrations, and downgradient.

A more detailed presentation of the Ecological Risk Assessment is given in the Final Ecological Risk Assessment report (CH2M Hill, 1999).

A component of the 2000 IROD was the conduct of two additional rounds of sampling and analysis in Wetland B/beaver pond as stated above to address the above areas of uncertainty and the possibility that sediment may be the source contributing to the elevated concentrations of lead and copper. This additional sampling and analysis was completed in 1999 and 2000. The analytical results of these sampling events are documented in the Analytical Data Package Report for Long-Term Monitoring of Operable Unit 1 (Year 1999 Samples), Hanscom AFB, MA. (IT, April 2000) and the Analytical Data Package Report for Long-Term Monitoring of Operable Unit 1, Hanscom AFB, MA. (IT, October 2000). Hanscom AFB's ecological risk consultant (CH2M Hill) reviewed the additional sediment and surface water data and concluded that the measured concentrations of copper and lead are low compared to background and ecological risk levels and there is no indication of a continuing source of either metal from OU 1. Also the low and variable hardness of the surface water seen in previous rounds was evident in the latest sampling. Thus low hardness seems to be the natural condition of this headwater area and not related to OU-1

or any other Air Force activities (CH2M Hill Technical Memorandum, December 13, 2000). Subsequently USEPA Region I concurred with Hanscom AFB's recommendation to cease ecological monitoring for lead and copper in surface water and sediments at OU-1 and to not take any other action relative to ecological risk.

2.7.3 Basis for Action

It was determined that COC concentrations in OU-1 groundwater exceed federal drinking water standards (i.e., MCLs and non-zero MCLGs), state drinking water standards (i.e., MCLs) and state groundwater risk characterization standards (i.e., MCP Method 1 GW-1 groundwater standards) at many locations, and that as a result there is an unacceptable risk to human health from groundwater ingestion. Therefore, actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

2.8 Remedial Action Objectives

Based on information relating to types of contaminants, environmental media of concern, and potential exposure pathways, remedial action objectives (RAOs) were developed to aid in the development and screening of alternatives. These RAOs were developed to mitigate, restore and/or prevent existing and future potential threats to human health and the environment. The following site-specific RAOs for Hanscom OU-1 groundwater are:

- Prevent exposure (via ingestion, inhalation and/or dermal contact) to groundwater containing COC concentrations that exceed federal drinking water standards (i.e., MCLs and non-zero MCLGs, state drinking water standards (i.e., MCLs), and state groundwater risk characterization standards (i.e., MCP Method 1 GW-1 standards);
- Prevent further migration of dissolved-phase COCs in groundwater;
- Prevent discharge to surface-water bodies and wetlands of groundwater containing COC concentrations that exceed federal drinking water standards, state drinking water standards, and state groundwater risk characterization standards; and
- Within an acceptable time period (< 30-50 years), return groundwaters to federal drinking water standards, state drinking water standards, and state groundwater risk characterization standards.
-

Secondary objectives are to ensue that excavation at the three source areas (IRP Sites 1, 2 and 3) is controlled to prevent exposure to any residual contamination in the subsurface soil and to prevent exposure to vapors that could accumulate in buildings affected by the contaminated groundwater plume.

The RAOs are meant to reduce and, over time, eliminate the potential for exposure of humans to VOCs in groundwater that are present in concentrations that exceed federal and state drinking water standards and state groundwater risk characterization standards and pose an unacceptable risk to human health and the environment. While contaminated soil remedial measures are not stated objectives of this remedial action, LUCs/ICs will also prevent human exposure to any residual subsurface soil contamination in the plume source areas which could pose an unacceptable risk to human health.

2.9 Development and Screening of Alternatives

2.9.1 Statutory Requirements/Response Objectives

Under its legal authorities, USEPA's primary responsibility at Superfund sites is to ensure that remedial actions are protective of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences, including: a requirement that Air Force's remedial action, when complete, must comply with all federal and more stringent state environmental and facility siting standards, requirements, criteria or limitations, unless a waiver is invoked; a requirement that Air Force select a remedial action that is cost-effective and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and a preference for remedies in which treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances is a principal element over remedies not involving such treatment. Response alternatives were developed to be consistent with these Congressional mandates.

2.9.2 Technology and Alternative Development and Screening

CERCLA and the NCP set forth the process by which remedial actions are evaluated and selected. Justification for a Focused Feasibility Study in 2000 was presented in the 2000 FFS Report. Continuation of the focused feasibility study approach for a revised/updated FFS was discussed during a January 29, 2007 Project Team meeting (representatives from Hanscom AFB, USEPA Region I and MADEP). The Project Team reviewed the justification for the 2000 FFS and concluded that the justification was even more valid in 2007 than it was in 2000 and that the focused feasibility study approach would continue to be followed to evaluate the remedial alternatives at OU-1 in a Revised FFS. This conclusion was based on the following:

1. Several remedial actions have already been conducted at the site to address known sources at OU-1. The remedial actions consisted of contaminated soil excavation to the water table at Site 1, and buried drum and contaminated soil excavation to the water table at Sites 2 and 3. These remedial actions were conducted under State authority prior to the listing of Hanscom AFB on the NPL. Also in 1997 an experimental vacuum enhanced recovery (VER) system consisting of four recovery wells was placed in operation in the immediate vicinity of Burn Pit #1 and Burn Pit #1 Runoff Area at Site 1 to accelerate the removal of contaminant mass from the bedrock aquifer at Site 1. Following a successful Demonstration Project (which concluded in April 1999), this system has been operated as a component of the OU-1 remedy. Operation of the VER was interrupted between June 2001 and September 2002 for a permanganate injection pilot study in the same Site 1 source area and, on 31 July 2006 operation of the VER was again interrupted for an additional permanganate treatment of the area. The combination of VER and permanganate injections has been successful in reducing the amount of contaminant mass at the major Site 1 source area. This progress is reflected in the LTM results for bedrock aquifer monitoring well RAP1-3R in the center of the VER/permanganate area which are shown on **Figure 17**. The location of this well/area is shown on **Figure 6**.

2. An effective groundwater collection, treatment and recharge system has already been installed at OU-1 and an effective long-term monitoring program (LTMP) dating back to 1986 is in place which monitors groundwater quality in the three aquifers below OU-1 (upper, lower, and bedrock). Initially the LTMP was designed to assess the nature and extent of groundwater contamination and develop the 1988 Remedial Action Plans. Between 1990 and 1998 the LTMP concentrated on the effects of the groundwater collection trenches/interceptor wells and treatment system and on further assessing the nature and extent of groundwater contamination. This was the data used for the FFS, Proposed Plan and IROD issued for OU-1 in 2000. Since 1999 the LTMP has concentrated on monitoring progress towards attainment of RAOs and remedial process optimization. The results of the LTMP since the 2000 IROD was issued have demonstrated that the groundwater remediation system is effective at removing contaminant mass at the source areas and within the contaminant plumes. In addition, the water quality and groundwater flow data collected at the boundary wells and wells in the both the on-site plumes and the off-site plumes (conservation lands owned by the Town of Bedford) indicate that the remedial system is effective in both containing contaminant migration in each of the surface, lower and bedrock aquifers and in pulling back the plumes towards their source areas. Therefore, it has been demonstrated over recent years that the existing system is a feasible technology to achieve RAOs in a reasonable period of time. A chart (**Figure 18**) of the LTM results for lower aquifer monitoring well B-248 in the off-site plume documents effectiveness of the remedial system. The location of this well is shown on **Figure 9**.
3. The LTMP results since 1997 do not appear to support assumptions used in CH2M Hill's solute transport model that was constructed using 1996 and 1997 LTMP results. That model could not predict when, if ever, RAOs would be achieved and resulted in the selection of an interim action to provided time to gather additional data. Charts of all actual LTM results to date (similar to **Figures 17 and 18**) were presented in the 2002 Five-Year Review Report which indicated that both the contaminant mass at the Site 1 and Site 2 source areas and the contaminant concentrations in the plumes flowing from these source areas were being reduced at a rate much faster than predicted by the solute transport model. These LTM charts have been updated annually since then and the trends seen in 2002 have continued. Updated charts with LTMP data through 2006 will be included in the 2007 Five-Year Review Report which is currently in the draft stage.
4. Because of the apparent reduction of chlorinated volatile organic compound (CVOC) contaminant concentrations in site ground water that was observed in the LTMP data set, in 2006 EPA Region I and Hanscom AFB partnered in preparing a "focused" solute transport model based on the LTMP results and the adjusted ground water extractions rates through 2005. During the January 2007 Project Team meeting the draft model was reviewed and evaluated. The focused solute transport model conservatively indicated that the existing interim remedy (dynamic groundwater remediation system) could achieve RAOs within a reasonable (<30-50 years) time frame. It was concurred that the "focused" model more likely reflected actual solute transport conditions for the area modeled and those results should be incorporated into a revised focused feasibility study.

It was decided at the January 2007 meeting that the scope of the 2007 Revised FFS would be to re-evaluate the following remedial alternatives in detail:

- Alternative G-1 – No Action
- Alternative G-2 – Limited Action - Land Use Controls and Monitoring
- Alternative G-3 – Existing Dynamic Groundwater Remediation System, Land Use Controls and Monitoring

2.9.3 Groundwater Flow and Transport Models

Multi-layer groundwater flow and solute transport models have been constructed to evaluate the contaminant fate and transport within the OU-1 area. These models have been used to predict plume positions under various remedial scenarios to include a no action scenario.

Please note that the modeling described in this document are considered to be conservative in that they do not factor in any biodegradation of the contaminate source (TCE) and any positive effects of future RPO actions to reduce the amount of residual sources and/or improve on-going remediation actions.

Groundwater Flow and Solute Transport Models using 1996 & 1997 LTMP Results
The initial models were constructed for Hanscom AFB by CH2M Hill using 1996 and 1997 LTMP data. The setup and calibration of the groundwater flow model was documented in the Draft Groundwater Flow Model Report, Operable Unit 1, Hanscom Air Force Base (CH2M Hill, 1997) and included in the 2000 FFS as Appendix A. For reference purposes this report was also included as Appendix A to the 2007 Revised FFS. The solute transport model was documented in the Draft Solute Transport Model Setup and Calibration Report, Operable Unit 1, Hanscom Air Force Base (CH2M Hill, 1997) and included in the 2000 FFS as Appendix B. For reference purposes it was also included as Appendix B to the 2007 Revised FFS.

The CH2M Hill groundwater flow model has proved useful and is considered to accurately represent the groundwater flow conditions in OU-1, however, the LTMP results since 1997 do not appear to support assumptions used in CH2M Hill's solute transport model. This transport model used the same computational grid as the flow model and the transport processes represented in the model were advection, dispersion, retardation, source-sink mixing, and first-order decay. The input parameters governing simulation of these processes were calibrated using TCE and vinyl chloride concentration data collected in Sampling Round No. 9 (July 1996) and No. 10 (May 1997). Because TCE was present at a much higher concentration than vinyl chloride and extended over a greater area, it was used as the primary indicator compound for the simulation. However, in order to calibrate the model to data points, separated by less than 1-year, constant-concentration TCE cells had to be assumed to be located in each of the three aquifers. Additionally, in both the lower and bedrock aquifers, these constant source cells had to be assumed to be located in areas away from the source areas.

Groundwater Flow and Solute Transport Models using LTMP Results through 2005
As stated above post-1997 LTMP data indicates that both the contaminant mass at the Site 1 and Site 2 source areas and the contaminant concentrations in the plumes flowing from these source areas were being reduced at a rate much faster than predicted by the initial solute transport model. The recent data also does not appear to support the use of constant

source cells, e.g., a constant source cell equaling 1,400 ug/L of TCE was assigned to the location of lower aquifer monitoring well B-248 in the off-site plume whereas the TCE concentration found in the November 2005 sampling and analysis of the groundwater in this well was 21.6 ug/L (duplicate = 18.6 ug/L). **Figure 18** (a chart of LTM TCE and cis-1,2-DCE concentrations in monitoring well B-248 since its initial sampling and analysis in July 1996 through 2006) graphically confirms the absence of a constant TCE source at this location.

In order to evaluate the alternatives identified in the 2007 Revised FFS a "focused" groundwater flow and contaminant transport model was developed that was based on LTMP results over eight (8) years (1997-2005). The setup and calibration of this groundwater flow and solute transport model are documented in a report dated May 2007 entitled: *Focused Ground Water Flow and Transport Model, Operable Unit One, Hanscom Air Force Base* prepared by CDW Consultants, Inc. The Finalized Report is included as **Appendix F** of this ROD. This modeling effort which used the latest version of MODFLOW (Version 4.2) did not have to include constant source cells in order to calibrate the model. It used a "starting" time of 1997 and an "ending" time of 2005 to calibrate the model. This model also conformed to the extent practicable to CH2M Hill's groundwater flow model. The CDW model was "focused" in that it covered a limited (4,000 foot square) area concentrating on Sites 1 and 2 and the conservation lands owned by the Town of Bedford as opposed to the OU-1 wide CH2M Hill model. The CDW model also only addressed the lower and bedrock aquifers since LTMP data indicates that the surficial aquifer has already been cleaned up. In addition to being able to use concentration changes over eight years for calibration the CDW model also was able to incorporate changes in the groundwater extraction rates that have occurred since 1997 as a result of the RPO initiatives discussed elsewhere in this document.

Appendix F Figures 4-1 and **4-2** show the simulated chlorinated volatile organic compounds (CVOC) solute plume in the lower aquifer in 1997 and 2005 respectively. And **Appendix F Figures 4-4** and **4-5** show the simulated CVOC solute plume in the bedrock aquifer in 1997 and 2005 respectively.

Groundwater flow was modeled in each of the above described models and the simulated water table for all three aquifers (unconfined, lower, and bedrock) indicated a general pattern of flow from the hills toward the lowlands, with discharge to Elm Brook, the Shawsheen River headwaters, and an un-named drainage channel in the conservation lands owned by the Town of Bedford. This modeled flow pattern is consistent with the flow patterns discussed in 2.5.2.1 above which are based on actual groundwater elevation measurements collected during LTMP Round 11

2.10 Description of Alternatives

Each remedy discussed in this section was designed to address threats posed by contaminated groundwater found below OU-1. As described in Section 2.9, Development and Screening of Alternatives, it was decided between USEPA, Hanscom AFB and MADEP that three remedies would be evaluated in the 2007 Revised FFS. The remedial remedies

considered, including the no action remedy, are summarized below. A more complete, detailed presentation of each remedy is found in Section 4.2 of the 2007 Revised FFS.

The removal of contaminated soil from IRP Sites 1, 2 and 3 was a component of the 1988 Remedial Action Plans developed for these 3 IRP Sites. This removal was completed in 1988. Subsequently the results of a soil to groundwater model using 1996 soil data concluded that the residual levels of VOCs detected in soils above the water table at that time would not likely have a significant adverse impact on ground water quality below Sites 1, 2, and 3. Thus remedial alternatives to address residual soil contamination at Sites 1, 2 and 3 were not evaluated in the 2007 Revised FFS. However, land use controls/institutional controls associated with Alternatives G-2 and G-3 would be protective of human health in regards to residual soil contamination.

OU-1 Groundwater Remedies

The remedial alternatives selected for detailed analysis for the OU-1 groundwater are as follows:

- Alternatives G-1 – No Action
- Alternatives G-2 – Limited Action - Land Use Controls and Monitoring
- Alternatives G-3 – Existing Dynamic Groundwater Remediation System, Land Use Controls and Monitoring

Table 2-7 summarizes the three remedies evaluated in the 2007 Revised FFS.

TABLE 2-7
Information Summary for the 3 Remedies

Remedial Alternative	Long-Term Reliability	Untreated Waste	Time for Design, Construction, and/or Implementation (yrs)	Time to Reach Remediation Goals (yrs)	Costs	Expected Outcome
Alternative G-1 – No Action	NA	No treatment undertaken. Therefore, all contaminants remain onsite.	0	50 yrs to reach steady state conditions, may never attain remediation goals.	Capital = $0 O&M = $0 Total present worth = $0 Discount rate = 7% Yrs remedy cost projected over = 30	No use of groundwater and no change in land use in the foreseeable future.
Alternative G-2 – Limited Action – Land Use Controls and Monitoring	NA - only monitoring	No treatment undertaken. Therefore, all contaminants remain onsite.	0	50 yrs to reach steady state conditions, may never attain remediation goals.	Capital = $0 O&M = $73,713 annually 5 yr reviews = $25,000 Total present worth = $1,032,678 Discount rate = 7% Yrs remedy cost projected over = 30	No use of groundwater and no change in land use in the foreseeable future.
Alternative G-3 – Existing Dynamic Groundwater Remediation System, Land Use Controls and Monitoring	Very reliable, system has been operating since 1991.	Contaminated groundwater is pumped to an on-site water treatment plant which has a capacity of 320 gpm. The treated water is discharged to the drainage channel or recharge basins.	0	Groundwater remediation system can effectively contain spread of contaminant plume. Drawback and elimination of plume expected over time (30-50 years)	Capital = $0 O&M = $545,244 annually 5 yr reviews = $25,000 Total present worth = $7,293,522 Discount rate = 7% Yrs remedy cost projected over = 30	No change in land use in the foreseeable future. Off-site (within Bedford's Jordan Conservation Area/Hartwell Town Forest) and on-site groundwater available for unlimited and unrestricted use as plume is pulled back to original contaminant release areas.

2.10.1 Alternative G-1—No Action

Description of No Action Remedy

Under this Alternative (which is required to be evaluated by law in all Feasibility Studies and Proposed Plans), no further effort or resources would be expended at the Hanscom AFB OU-1 site. This remedy calls for stopping operation of the existing dynamic groundwater remediation system that originally was started in 1991 and ending the LTMP that was initiated in 1986. Several changes have been made to the system since 1991. The groundwater remediation system currently consists of three groundwater collection trenches in the surficial aquifer, eleven interceptor wells screened in the lower and/or bedrock aquifers, a four-well vacuum enhanced recovery (VER) system screened in the bedrock aquifer, a groundwater treatment facility and on-site recharge/off-site discharge facilities. The groundwater remediation system also includes periodic permanganate injections at Site 1 and an in-situ reactive zone (IRZ) created by the injection of molasses in the on-site Site 1 plume. A detailed description of the groundwater remediation system and the LTMP is presented in Section 4.2.3 of the 2007 Revised FFS. Alternative G-1 does not include any additional system operation or groundwater monitoring. However, while institutional controls are not a component of this alternative, physical controls are already in-place which control access to the three source areas (IRP Sites 1, 2 and 3) and groundwater on the active commercial airport owned by the Commonwealth of Massachusetts and operated by Massport and the FAA. These include security fencing, active patrolling by security forces and controlled entry, limited to authorized personnel. In addition construction of the OU-1 recharge basins placed 6-8 feet of clean soil over the original ground surface of the waste burial pits at IRP Sites 2 and 3.

Groundwater Flow and Solute Transport Models have been used to simulate this No Action Remedy. The models indicated that a steady-state condition for the migration of the contaminant plume is reached after approximately 50 to 100 years. Once the steady-state condition is achieved, the contaminant plume is not expected to migrate any farther. Please note that CDW "focused' model prepared in 2007 evaluated the conditions after a simulated shut down of the system in 2005 (**Appendix F**). To that extent, the CDW model may be considered to specifically reflect future aquifer conditions if the dynamic remediation system were to be shut down (i.e. No Action Alternative/Natural Flow Conditions). A more detailed description of the groundwater flow and solute transport models, along with the No Action model simulation, is included in the Revised Focused Feasibility Study. It should also be noted that it is difficult at this time to predict when the Remedial Action Objectives will be met under this remedy, and if they will ever be met under this remedy.

Because contaminated media would be left on the site, a review of the site conditions would be required every 5 years. The review is specified in the National Contingency Plan (NCP). Alternative G-1 serves as the baseline against which the effectiveness of other remedies is judged.

2.10.2 Alternative G-2—Limited Action – Land Use Controls and Monitoring

Description of Limited Action Remedy

This Alternative is similar to Alternative G-1 except that the LTMP will be continued to assess and monitor the potential risks caused by the contaminants to human and ecological

receptors and land use controls (LUCs), including institutional controls (ICs), will be put in place, maintained and enforced to prevent exposure to hazardous substances above permissible levels. As with Alternative G-1 the OU-1 groundwater remediation system would be stopped. For OU-1 LUCs/ICs, which include non-engineered instruments such as legal and/or administrative controls, will prevent exposure to and use of contaminated groundwater, ensure that excavation at the three source areas (IRP Sites 1, 2 and 3) is controlled to prevent exposure to any residual contamination in the subsurface soil, and prevent exposure to vapors that could accumulate in buildings effected by the contaminated groundwater plume. ICs are considered acceptable measures to be used as part of a balanced cleanup when treatment is also being used to address principle waste threats.

Physical controls are already in-place to control access to the three source areas (IRP Sites 1, 2 and 3) and groundwater on the active commercial airport owned by the Commonwealth of Massachusetts and operated by Massport and the FAA. These include security fencing, active patrolling by security forces and controlled entry, limited to authorized personnel. In addition construction of the OU-1 recharge basins placed 6-8 feet of clean soil over the original ground surface of the waste burial pits at IRP Sites 2 and 3.

The objective of LUCs/ICs is to provide that future land use remains compatible with the land use that was the basis for evaluation, selection, and implementation of the response action. LUCs/ICs are a common component of any response action that does not allow for unrestricted land use following the completion of the response action or when the response action allows for unrestricted use, but there is a need to protect the integrity of the remedy. Please see the discussion of LUCs/ICs for the selected remedy in 2.12.3 below for the details concerning LUCs already in placed for OU-1.

A long-term monitoring program (LTMP) has been in effect for OU-1 since 1986. This remedy includes the continuation of groundwater monitoring at OU-1, but a revised LTMP would be needed if this alternative was implemented to account for the cessation of active remediation and the absence of an on-site operation and maintenance staff to conduct the sampling and do some of the analysis on-site. The inactive interceptor/recovery, monitoring wells and surface water monitoring points to be included in the LTMP for this alternative were selected based upon their geographical location, screened aquifer, and historical contaminant levels/trends. Selected monitoring points include wells for the Upper, Lower, and Bedrock Aquifers in the following geographic areas of the site:

- from within the known OU-1 source areas to assess any potential changes in contaminant concentrations in these source areas;
- the downgradient portion of on-site contaminant plumes,
- wells along the boundary of Hanscom Field/Hanscom AFB with the conservation lands owned by the Town of Bedford,
- wells in the conservation lands owned by the Town of Bedford/off-site OU-1 plume, and
- both on-site and off-site surface monitoring points.

Table 2-8: Alternative G-2 - Limited Action - Land Use Controls and Monitoring Long-Term Monitoring Program (LTMP)	
Sampling Point	***Surface Water - Rationale***
RAP1-SW4	Surface Water Sample Location in Drainage Channel
SW202	Surface Water Sample Location in Bedford Forest - Wetland B/Beaver Pond Area
SW203	Surface Water Sample Location in Bedford Forest - Wetland B/Beaver Pond Area
Well	***Surface Aquifer - Rationale***
B101-MW	Monitor surface aquifer approaching boundary and downgradient of Site 2
B102-MW	Monitor changes in contaminate levels at Hanscom Field/Bedford Forest boundary
B105-MW	Monitor surface aquifer at downgradient side of the Site 2 collection trench
B116-MW	Monitor surface aquifer at downgradient side of the Site 3 collection trench
B117-MW	Monitor surface aquifer at downgradient side of the Site 3 collection trench
B118-MW	Monitor surface aquifer at downgradient side of the Site 3 collection trench
B234-MW	Monitor surface aquifer downgradient of Site 3
B238-MW	Monitor surface aquifer downgradient of Site 1 collection trench
B241-MW	Monitor surface aquifer approaching boundary and downgradient of Site 1
B246-MW	Downgradient/Bedford Forest outpost well
B247-MW	Downgradient/Bedford Forest outpost well
B250-MW	Downgradient/Bedford Forest outpost well
B253-MW	Downgradient/Bedford Forest outpost well
OW2-1	Monitor surface aquifer at downgradient side of the Site 2 collection trench
OW2-8	Monitor surface aquifer downgradient of the Site 2 source areas vic collection trench
OW3-14	Monitor surface aquifer at downgradient side of the Site 3 collection trench
RAP1-4S	Monitor changes in contaminate levels at Hanscom Field/Bedford Forest boundary
RAP1-6S	Monitor changes in on-site Site 1 plume & surface aquifer discharges to drainage ditch
RAP2-2S	Monitor surface aquifer approaching boundary and downgradient of Sites 1 and/or 2
RAP2-3S	Monitor changes in contaminate levels at Hanscom Field/Bedford Forest boundary
RAP3-3S	Monitor historical surface aquifer hotspot
RAP3-4S	Monitor historical surface aquifer hotspot
RFW-11	Monitor surface aquifer at downgradient side of the Site 2 collection trench
Well	**Lower Aquifer - Rationale**
B104-MW*	Monitor surface/lower aquifer at Site 1 collection trench
B108-MW	Monitor lower aquifer approaching boundary and downgradient of Site 2
B109-MW	Monitor lower aquifer at downgradient side of the Site 2 collection trench
B111-MW	Monitor changes in contaminate levels at Hanscom Field/Bedford Forest boundary
B114-MW	Monitor lower aquifer at downgradient side of the Site 2 collection trench
B115-MW	Monitor lower aquifer below Site 2 source areas
B121-MW	Monitor lower aquifer at downgradient side of the Site 3 collection trench
B122-MW	Monitor lower aquifer at downgradient side of the Site 3 collection trench
B125-MW	Monitor lower aquifer below Site 3 source areas
B126-MW	Monitor changes in contaminate levels at Hanscom Field/Bedford Forest boundary
B239-MW	Monitor lower aquifer downgradient of Site 1 collection trench
B242-MW	Monitor lower aquifer approaching boundary and downgradient of Site 1
B245-MW	Downgradient/Bedford Forest outpost well
B248-MW	Downgradient/Bedford Forest outpost well
B251-MW	Downgradient/Bedford Forest outpost well
B254-MW	Downgradient/Bedford Forest outpost well
CW-4	Monitor lower aquifer downgradient of Site 1 collection trench
P02-1T	Monitor changes in contaminate levels at Hanscom Field/Bedford Forest boundary
P02-2T	Monitor changes in contaminate levels at Hanscom Field/Bedford Forest boundary
RAP1-1T*	Monitor changes in contaminate levels at Hanscom Field/Bedford Forest boundary
RAP1-3S*	Site 1 Burn Pit #1 (source area) Runoff Area
RAP1-5S*	Monitor surface/lower aquifer at Site 1 collection trench
RAP1-6T	Monitor changes in on-site Site 1 plume
RAP2-1T	Monitor changes in contaminate levels at Hanscom Field/Bedford Forest boundary
RAP2-2T	Monitor lower aquifer approaching boundary and downgradient of Sites 1 and/or 2
RAP2-3T	Monitor changes in contaminate levels at Hanscom Field/Bedford Forest boundary
RAP3-3T	Monitor lower aquifer below historic Site 3 hotspot
RAP3-4T	Monitor lower aquifer below historic Site 3 hotspot
V-1	Site 1 Burn Pit #2 (source area)
Well	***Bedrock Aquifer - Rationale***
B131-MW	Monitor Bedrock aquifer at downgradient side of the Site 3 collection trench
B132-MW	Monitor Bedrock aquifer at downgradient side of the Site 3 collection trench
B237-MW	Monitor historical bedrock aquifer hotspot
B240-MW	Monitor bedrock aquifer downgradient of Site 1 collection trench
B243-MW	Monitor bedrock aquifer approaching boundary and downgradient of Site 1
B244A-MW	Downgradient/Bedford Forest outpost well
B249-MW	Downgradient/Bedford Forest outpost well
B252-MW	Downgradient/Bedford Forest outpost well
B255-MW	Downgradient/Bedford Forest outpost well
GM MW-1	Site 1 Burn Pit #1 (source area)
P02-1RA	Monitor changes in contaminate levels at Hanscom Field/Bedford Forest boundary
P02-2R	Monitor changes in contaminate levels at Hanscom Field/Bedford Forest boundary
PT1-RA	Monitor changes in contaminate levels at Hanscom Field/Bedford Forest boundary
RAP1-1R	Monitor changes in contaminate levels at Hanscom Field/Bedford Forest boundary
RAP1-2R	Monitor bedrock aquifer at Site 1 collection trench
RAP1-3R	Site 1 Burn Pit #1 (source area) Runoff Area
RAP1-4RA	Monitor changes in contaminate levels at Hanscom Field/Bedford Forest boundary
RAP1-5R	Monitor bedrock aquifer at Site 1 collection trench
RAP1-6R	Monitor changes in on-site Site 1 plume
RAP2-1R	Monitor changes in contaminate levels at Hanscom Field/Bedford Forest boundary
RAP2-2R	Monitor bedrock aquifer approaching boundary & downgradient of Sites 1 and/or 2
RAP2-3R	Monitor changes in contaminate levels at Hanscom Field/Bedford Forest boundary
Notes: a) 3 surface water points and 74 monitoring wells sampled annually b) No sampling associated with collection system (wells or trenches) since groundwater remediation system would not be operating c) * Wells monitor both the surface and lower aquifers because the lacustrine layer is non-existant at these locations	

The proposed LTMP is summarized in **Table 2-8** on the preceeding page. It includes 77 sampling points to be sampled annually and analyzed by an off-site commercial laboratory for VOCs using EPA Method 8260A. The geographical location of the proposed monitoring points (as well as all other historical interceptor/monitoring well and surface water sampling points in OU-1) are shown in **Figure 9.**

Groundwater Flow and Solute Transport Models have been used to simulate this Limited Action-Monitoring Remedy which includes ceasing operation of the existing groundwater remediation system. The models indicated that a steady-state condition for the migration of the contaminant plume is reached after approximately 50 to 100 years. Once the steady-state condition is achieved, the contaminant plume is not expected to migrate any farther. Please note that CDW "focused' model prepared in 2007 evaluated the conditions after a simulated shut down of the system in 2005 (**Appendix F**). To that extent, the CDW model may be considered to specifically reflect future aquifer conditions if the dynamic remediation system were to be shut down (i.e. Limited Action/Natural Flow Conditions). A more detailed description of the groundwater flow and solute transport models, along with the Limited Action model simulation, is included in the Revised Focused Feasibility Study. It should also be noted that it is difficult at this time to predict when the Remedial Action Objectives will be met under this remedy, and if they will ever be met under this remedy. Because contaminated media would be left on the site in concentrations above levels that allow unrestricted exposure and unlimited use, a review of the site conditions would be required every 5 years. Each review will involve site inspections and a summary report which includes a data evaluation of sampling and analysis results collected since the last review. The review is specified in CERCLA and the NCP.

2.10.3 Alternative G-3 – Existing Dynamic Groundwater Remediation System, Land Use Controls and Monitoring

Description of the Existing Dynamic Groundwater Remediation System

Active OU-1 groundwater remediation started in 1991 and the original groundwater collection, treatment and recharge system consisted of groundwater collection trenches in the surficial aquifer at each of the three source areas (Sites 1, 2 & 3), four boundary interceptor wells (BIWs) screened in both the lower and bedrock aquifers, two recharge basins (at Site 2 & 3) and a central groundwater treatment system. The extracted groundwater is piped to the central groundwater treatment plant for treatment by air stripping, and is then discharged, either to recharge basins at Sites 2 and 3, and/or to a drainage ditch which flows into the wetlands north of the Hanscom Field runways.

In recent years, the OU-1 remedial action has been considered a "dynamic" groundwater remediation system. The term "dynamic" is included in the remedy designation to reflect the Air Force's Remedial Process Optimization (RPO) Program to improve the effectiveness of on-going remedial actions. The RPO process at OU-1 commenced in 1996 with the automation of the system which allowed for unmanned operation/reduction in operating staff. Also at this time the pump stations at IRP Sites 1, 2 and 3 were upgraded with larger pumps to both overcome iron bacteria fouling in the piping and to provide the capability to pump all that the collection trenches and interceptor wells could yield. Then in 1997 variable speed drives were added to these pumps to provide the capability to regulate flows as needed for optimal contaminant mass recovery while also serving as an energy conservation measure. Subsequent RPO initiatives included additions of flow meters for the

collection system pumps, upgrades of the originally installed pumps in the 4 BIW's, installation of additional interceptor wells, and the incorporation of additional remediation technologies to augment the basic pump and treat technology. These include source removal and destruction at Site 1 via VER and permanganate injections and enhancement of contaminant biodegradation via molasses injections in the on-site Site 1 plume. To date these source removal/destruction actions have been effective in reducing the source of the OU-1 groundwater contamination. The continuation of the effectiveness of source removal/destruction actions such as the above or other "to be determined" actions is vital to the achievement of RAOs.

RPO is not just additions/upgrades but also includes subtractions as evidence by the suspension of groundwater collection at Site 3 in August 2001 when monitoring data indicated that groundwater contamination within the collection trench's area of influence had been reduce to the point that the groundwater met drinking water standards. Site 3 is currently in a monitoring only mode. It is expected that in the future there will be additional suspensions and/or "pulsed" operation of pumps followed by monitoring for rebounds in contaminate level within the area of influence of a collection trench/interceptor well. And, at some time in the future as additional sections of OU-1 achieve RAOs it is expected that the size of the treatment plant will be downgraded to match the diminished incoming flows. The RPO process is a component of Alternative G-3 and additional RPO initiatives are expected to be made in the future, as suggested by operational experience, monitoring and the evolution of new applicable remediation technologies. The ultimate purpose of RPO is to complete the cleanup in the most cost effective and timely manner possible.

The elements of the groundwater remediation system are shown in **Figure 5** and a more detailed description of the existing dynamic groundwater remediation system is presented in Section 4.2.3 of the 2007 Revised FFS and also in Section 2.13, The Selected Remedy, of this ROD.

Land Use Controls

For OU-1 LUCs/ICs, which include non-engineered instruments such as legal and/or administrative controls, will prevent exposure to and use of contaminated groundwater, ensure that excavation at the three source areas (IRP Sites 1, 2 and 3) is controlled to prevent exposure to any residual contamination in the subsurface soil, and prevent exposure to vapors that could accumulate in buildings effected by the contaminated groundwater plume. ICs are considered acceptable measures to be used as part of a balanced cleanup when treatment is also being used to address principle waste threats.

Physical controls are already in-place to control access to the three source areas (IRP Sites 1, 2 and 3) and groundwater on the active commercial airport owned by the Commonwealth of Massachusetts and operated by Massport and the FAA. These include security fencing, active patrolling by security forces and controlled entry, limited to authorized personnel. In addition construction of the OU-1 recharge basins placed 6-8 feet of clean soil over the original ground surface of the waste burial pits at IRP Sites 2 and 3.

The objective of LUCs/ICs is to provide that future land use remains compatible with the land use that was the basis for evaluation, selection, and implementation of the response action. LUCs/ICs are a common component of any response action that does not allow for unrestricted land use following the completion of the response action or when the response action allows for unrestricted use, but there is a need to protect the integrity of the remedy. Please see the discussion of LUCs/ICs for the selected remedy in 2.12.3 below for the details concerning LUCs already in placed for OU-1.

Monitoring

A LTMP has been in effect for OU-1 since 1986. An extensive network of groundwater interceptor, recovery and monitoring wells has been developed over time and 20 major/formal LTMP rounds have been conducted to monitor contaminant levels/trends in the surface water and groundwater in each of the 3 aquifers of concern within OU-1. Each of these 20 LTMP rounds have been documented in an LTM Report and the Report for the most recent LTMP round in November 2006 is provided as Appendix C in the 2007 Revised FFS. Also **Table 2-2** and **Figures 10** through **12** of this ROD are extracts from this report which document the groundwater contamination found in the 2006 LTM round.

The post-1998 LTMP for OU-1 has been 2-phased; (1) the annual sampling of selected monitoring wells and a surface water sampling point for analysis of VOCs by an off-site commercial laboratory, and (2) the monthly/ quarterly/semi-annually/annually sampling of collection points, selected monitoring and the surface water sampling point for analysis by the O&M staff using an on-site gas chromatograph (GC). Please note the analysis with the on-site GC only quantifies the two principal contaminants of concern, TCE and Cis-1,2-DCE. The LTMP has also been subject to the RPO process in that sampling points and frequency are re-evaluated after each round for changes necessary to more effectively accomplish the objectives of LTMP.

The proposed LTMP for this remedy continues the two-phase approach. but includes the laboratory analysis of fewer samples (34) than Remedy G-2. However, when combined with the on-site GC analysis the LTMP for this remedy will provide more data to assess the effectiveness of the remedial effort and progress towards attainment of RAOs and the complete cleanup of OU-1. Please see the discussion of Monitoring for the selected remedy in 2.12.3 below for additional details concerning the proposed LTMP for this remedy.

Please note the LTMP will continue to be subject to the RPO process in that the sampling points and frequency are re-evaluated after each event for changes necessary to more effectively accomplish the objectives of LTMP.

Groundwater Flow and Transport Modeling

Groundwater Flow and Solute Transport Models have been used to simulate the remedial alternatives identified in the Revised FFF (No Action, Limited Action -Monitoring and the Dynamic Groundwater Remediation System). The initial models were developed by CH2M Hill in conjunction with the 2000 FFS. Subsequently, as a component of the 2007 Revised FFS, a "focused" model was developed by CDW Consultants (**Appendix F**). For Alternative G-3 both models' simulations predicted that continued operation of the existing remediation system would effectively contain contaminant migration and prevent the further expansion

of the plume, and should actually reduce the overall extent of the plume. However, after 30-years of active remediation, the CH2M Hill model's plumes continued to extend into the conservation lands owned by the Town of Bedford and it was also apparent that the plumes would not be eliminated unless the continuous sources assumed to be present were removed/eliminated.

As with CH2M Hill's model CDW's focused model's simulations predict that continued operation of the existing remediation system would effectively contain contaminant migration and prevent the further expansion of the plume. However, there was a major difference between the two models in that the CDW focused model also predicts that both the lower and bedrock aquifer's CVOC plume concentrations should be reduced to less than MCLs in less than 50-years. Since total CVOCs (MCLs vary by specific compounds) have been modeled (as opposed to TCE alone) the predicted time to reach a specific MCL can not be determined, however, LTMP data indicates that the ratio of TCE to cis-1,2-DCE has been in a long-term decline and that as time goes on the principal residual contaminant should be cis-1,2-DCE which has an MCL of 70 ug/L as opposed to TCE with an MCL of 5 ug/L. Thus the modeler's conclusion that this alternative will meet MCLs within 30-50 years is a reasonable conclusion.

The CDW model's predicted contaminant (CVOC) concentrations distribution in the lower aquifer after 30 (2027) and 50 (2047) years of operation are illustrated in **Appendix F Figures 5-1** and **5-2** respectively. And the predicted contaminant (CVOC) concentrations distribution in the bedrock aquifer after 30 (2027) and 50 (2047) years of operation are illustrated in **Appendix F Figures 5-3** and **5-4** respectively.

Also please note that both models' predictions are considered to be conservative and present worse case scenarios since they do not factor in any biodegradation of the contamination in migrating ground water (TCE) and any positive effects of future RPO actions to further reduce the amount of residual sources and/or improve on-going remediation actions such as adjustment of existing ground water extraction rates. These factors will likely contribute to accelerate attainment of ROAs under this alternative.

A more detailed description/discussion of the groundwater flow and solute transport models, along with model simulations of the existing dynamic groundwater remediation system, is included in the 2007 Revised FFS.

Summary
Alternative G-3 provides for the reduction in contaminant mass and containment of the groundwater plume. Continued operation of the dynamic groundwater remediation system will, over time, permanently eliminate the source of groundwater contamination and provide permanent aquifer restoration. In the interim LUCs/ICs will effectively ensure that groundwater is not used for human consumption and that future land use does not increase the risk of exposure to contaminants remaining on site whilst the remedy operates to meet the cleanup goals. Progress towards attainment of RAOs will be documented by monitoring which will also confirm that residual contaminant sources are being removed/destroyed, that the dissolved-phase plume is contained/being reduced, and that groundwater

containing COC concentrations exceeding ARARs is not discharging into the surface water/wetlands of OU-1.

Because contaminated media would initially be left on the site, a review of the site conditions would be required every 5 years until groundwater contamination attains levels that allow for unlimited use and unrestricted exposure. Each review will involve site inspections and a summary report which includes a data evaluation of operational and sampling and analysis results collected since the last review. The review is specified in CERCLA and the NCP.

2.11 Summary of the Comparative Analysis of Alternatives

Section 121(b)(1) of CERCLA presents several factors that at a minimum the USAF is required to consider in its assessment of alternatives. Building upon these specific statutory mandates, the NCP articulates nine evaluation criteria to be used in assessing the individual remedial alternatives.

2.11.1 Nine Evaluation Criteria

A detailed analysis was performed on the alternatives using the nine evaluation criteria in order to select a site remedy. The following is a summary of the comparison of each alternative's strength and weakness with respect to the nine evaluation criteria. These criteria are summarized as follows:

2.11.1.1 Threshold Criteria

The two threshold criteria described below must be met in order for the alternatives to be eligible for selection in accordance with the NCP:

1. Overall protection of human health and the environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.
2. Compliance with applicable or relevant and appropriate requirements (ARARs) addresses whether or not a remedy will meet all Federal environmental and more stringent State environmental and facility siting standards, requirements, criteria or limitations, unless a waiver is invoked.

2.11.1.2 Primary Balancing Criteria

The following five criteria are utilized to compare and evaluate the elements of one alternative to another that meet the threshold criteria:

3. Long-term effectiveness and permanence addresses the criteria that are utilized to assess alternatives for the long-term effectiveness and permanence they afford, along with the degree of certainty that they will prove successful.
4. Reduction of toxicity, mobility, or volume through treatment addresses the degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the site.
5. Short term effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup goals are achieved.

6. Implementability addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.
7. Cost includes estimated capital and Operation Maintenance (O&M) costs, as well as present-worth costs.

2.11.1.3 Modifying Criteria

The modifying criteria are used as the final evaluation of remedial alternatives, generally after USEPA has received public comment on the RI/FS and Proposed Plan:
8. State acceptance addresses the State's position and key concerns related to the preferred alternative and other alternatives, and the State's comments on ARARs or the proposed use of waivers.

9. Community acceptance addresses the public's general response to the alternatives described in the Proposed Plan and RI/FS report.

2.11.2 Comparative Analysis

Following the detailed analysis of each individual alternative, a comparative analysis, focusing on the relative performance of each alternative against the nine criteria, was conducted. A synopsis of this comparative analysis can be found in **Table 2-9** below.

Table 2-9 Comparative Evaluation of Interim Alternatives to Nine CERCLA Criteria

Evaluation Criteria	Alt.1 No Action	Alt. 2 Limited Action – Land Use Controls and Monitoring	Alt. 3 Existing Dynamic Groundwater Remediation System, Land Use Controls and Monitoring
Relevant Section in Feasibility Study	4.2.1	4.2.2	4.2.3
Threshold Criteria			
Overall Protection of Human Health and the Environment	○	◖	●
Compliance with ARARs	○	◖	●
Primary Balancing Criteria			
Long-Term Effectiveness and Permanence	○	○	●
Reduction of Toxicity, Mobility, or Volume Through Treatment	○	○	●
Short-Term Effectiveness	●	●	●
Implementability	●	●	●
Cost - Present worth ($)	0	1,032,678	7,293,522
Modifying Criteria			
State Acceptance	○	○	●
Community Acceptance	○	○	●

● Meets or exceeds criteria ○ Does not meet criteria

◖ Partially meets criteria TBD = To be determined

2.11.3 Narrative Summary

The section below presents the nine criteria and a brief narrative summary of the alternatives and the strengths and weaknesses according to the detailed and comparative analysis.

2.11.3.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.

- Alternative G-1 – No Action - does not provide long-term protection of human health and the environment. This alternative does not provide protection from groundwater contaminant concentrations exceeding chemical-specific ARARs. The risk of potential exposure may increase since contaminant plumes are expected to resume their pre-RA migration patterns when the current Hanscom AFB groundwater remediation system is shut down. This alternative does not provide measures to eliminate or contain contaminant source areas and/or existing plumes. The plumes are anticipated to continue to expand through groundwater migration, surface water migration, and infiltration until a steady-state condition is achieved. Because groundwater monitoring is not included in this alternative, there would be no mechanism to assess and monitor changes in the potential risks caused by the contaminants to human and ecological receptors. Alternative G-1 does not have the ability to meet the RAOs.

- Alternative G-2 – Limited Action – Land Use Controls and Monitoring - provides some long-term protection of human health and the environment in that LUCs/ICs will prevent exposure to and use of contaminated groundwater, ensure that excavation at the three source areas (IRP Sites 1, 2 and 3) is controlled to prevent exposure to any residual contamination in the subsurface soil, and prevent exposure to vapors that could accumulate in buildings effected by the contaminated groundwater plume. Because groundwater monitoring is included in this alternative, there would a mechanism to assess and monitor changes in the potential risks caused by the contaminants to human and ecological receptors. However, the risk posed by the groundwater contaminant concentrations exceeding chemical-specific ARARs would not be reduced. The risk of potential exposure may increase since contaminant plumes are expected to resume their pre-RA migration patterns when the current Hanscom AFB groundwater remediation system is shut down. This alternative does not provide measures to eliminate or contain contaminant source areas and/or existing plumes. The plumes are anticipated to continue to expand through groundwater migration, surface water migration, and infiltration until a steady-state condition is achieved. Alternative G-2 will reduce the risk of exposure to contaminated groundwater, however, it will not attain ARARs in a reasonable time period and does not have the ability to meet the other RAOs.

- Alternative G-3 – Existing Dynamic Groundwater Remediation System, Land Use Controls and Monitoring – would be completely protective of human health and the environment. LUCs/ICs (whilst the remedy operates to meet the cleanup goals) will prevent exposure to and use of contaminated groundwater, ensure that excavation at the

three source areas (IRP Sites 1, 2 and 3) is controlled to prevent exposure to any residual contamination in the subsurface soil, and prevent exposure to vapors that could accumulate in buildings effected by the contaminated groundwater plume. Monitoring will confirm that residual contaminant sources are being removed/destroyed, that the dissolved-phase plume is contained, and that groundwater containing COC concentrations exceeding ARARs is not discharging into the surface water/wetlands of OU-1. Continued operation of the dynamic groundwater remediation system will, over time, permanently eliminate the plumes of contaminated groundwater and the source of groundwater contamination. Also, based on the CDW model, there is now a reasonably estimated 30-50 year time frame to complete the cleanup. In the interim the volume and toxicity of the residual contaminants at the site (dissolved-phase plume and residual contaminants at the source areas) will continue to decrease due to continued recovery from the collection trenches and interceptor wells; source removal/destruction actions such as the continued operation of the VER system and/or permanganate injections at Site 1, and natural attenuation. Alternative G-3 has the ability to meet all four of the RAOs; prevent exposure to contaminated groundwater, prevent migration of contaminated groundwater, prevent discharge of contaminated groundwater to surface water bodies, and, within an acceptable time period (30-50 years), return groundwaters to federal drinking water standards, state drinking water standards, and state groundwater risk characterization standards.

2.11.3.2 Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA requires that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA section 121(d)(4).

Applicable requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address hazardous substances, the remedial action to be implemented at the site, the location of the site, or other circumstances present at the site. Relevant and appropriate requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law which, while not applicable to the hazardous materials found at the site, the remedial action itself, the site location or other circumstances at the site, nevertheless address problems or situations sufficiently similar to those encountered at the site that their use is well-suited to the site.

Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes or provides a basis for invoking a waiver.

Please note that chemical-specific ARARs are based on the RAOs. While the on-site groundwater is not currently (and is never anticipated to be) used for human consumption, the area of OU-1 has been zoned as GW-1 (must meet levels similar to federal MCLs) by town of Bedford bylaw through a process permitted by state regulation. Additionally, MADEP has classified groundwater in this area as Class I "high use and value."

- Alternative G-1 – No Action would not achieve the chemical-specific ARARs within the groundwater plume at OU-1 because federal and state MCLs, federal **non-zero** MCLGs and state MCP Method 1 GW-1 standards will not be met in the short-term. For Alternative G-1 there are no action-specific ARARS and location-specific ARARS are not impacted because no action will be undertaken to protect public health and the environment.

- Alternative G-2 – Limited Action – Land Use Controls and Monitoring would not achieve the chemical-specific ARARs within the groundwater plume at OU-1 because federal and state MCLs, federal **non-zero** MCLGs and state MCP Method 1 GW-1 standards will not be met in the short-term. The monitoring component of this remedy would comply with all location-specific ARARS, including federal Protection of Wetlands and Floodplains requirements, the Fish and Wildlife Coordination Act, and the Massachusetts Wetlands Regulation. The remedy would comply with all action-specific ARARs, including federal Ambient Water Quality Criteria and the Massachusetts Surface Water Quality Standards.

- Alternative G-3 – Existing Dynamic Groundwater Remediation System, Land Use Controls and Monitoring would meet chemical-specific ARARs (federal and state drinking water standards) for the treated groundwater and Remediation Goals (cleanup levels which are also federal and state drinking water standards) should be met for the groundwater in OU-1 within a reasonable time period. The remedy would comply with all location-specific ARARS, including federal Protection of Wetlands and Floodplains requirements, the Fish and Wildlife Coordination Act, and the Massachusetts Wetlands Regulation. The remedy would comply with all action-specific ARARs, including federal National Pollutant Discharge Elimination System (NPDES) Regulations, Underground Injection Control (UIC) Program requirements, Resource Conservation and Recovery Act (RCRA) requirements, EPA Policy on Control of Emissions from Superfund Air Strippers; and the Massachusetts Surface Water and Groundwater Discharge Permit Programs, UIC Program, Hazardous Waste Management Rules, Erosion and Sediment Control Guidelines for Urban and Suburban Areas, Well Decommissioning requirements, Rules for Remedial Air Emissions, Air Pollution Control Regulations, Off-Gas Treatment of Point Source Remedial Air Emissions Policy, Standards for Analytical Data for Remedial Response Action, and Threshold Exposure Limits and Allowable Ambient Limits.

2.11.3.3 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual risk and the adequacy and reliability of controls.

- Alternative G-1 – No Action does not provide long-term effectiveness and permanence. The risk currently associated with exposure to contaminants at the site would not be decreased and might be increased by the future migration of contaminants until a steady-state condition is achieved. Under this alternative, the source of contamination would not be remediated, and there would not be containment of the existing plume.

There is also no monitoring program that could be used to track the migration of the plume, and provide a warning against increased risks.

- Alternative G-2 – Limited Action – Land Use Controls and Monitoring does not provide long-term effectiveness and permanence. The risk currently associated with exposure to contaminants at the site would not be decreased and might be increased by the future migration of contaminants until a steady-state condition is achieved. However, LUCs/ICs should effectively reduce the risk of exposure by controlling the access and exposure to the contaminated media. Monitoring should also reduce the risk to human health by delineating any changes in the extent of contamination in the groundwater. A monitoring program would provide an early warning mechanism, in that data would be collected that might reveal increased contaminant concentrations and increased plume migration that would warrant the implementation of additional actions. Under this alternative, the source of contamination would not be remediated and there would not be containment of the existing plume. Because of contaminants left at the site, a review of site conditions would be required every 5 years.

- Alternative G-3 – Existing Dynamic Groundwater Remediation System, Land Use Controls and Monitoring provides long-term effectiveness and permanence. This alternative will effectively protect human health and the environment by the gradual elimination of the sources of the groundwater contamination while containing and reducing the groundwater contamination plumes, as long as the remedial system continues to operate. If remediation is terminated before the complete removal of the residual contaminants in the source areas (IRP Sites 1, 2 and/or 3), contaminants are expected to resume migrating away from the source areas into Bedford Town Forrest, where they will discharge to surface water and biodegrade, eventually reaching a steady-state condition. Continued operation of the dynamic groundwater remediation system will, over time, permanently eliminate the source of groundwater contamination and provide permanent aquifer restoration. Also, based on the CDW model, there is now a reasonably estimated "near" time to achieve the cleanup. In the interim LUCs/ICs (whilst the remedy operates to meet the cleanup goals) should effectively prevent exposure to and use of contaminated groundwater, ensure that excavation at the three source areas (IRP Sites 1, 2 and 3) is controlled to prevent exposure to any residual contamination in the subsurface soil, and prevent exposure to vapors that could accumulate in buildings effected by the contaminated groundwater plume. Monitoring should also reduce the risk to human health by delineating any changes in the extent of contamination in the groundwater. A monitoring program would provide an early warning mechanism, in that data would be collected that might reveal increased contaminant concentrations and increased plume migration that would warrant the implementation of additional actions. Because contaminants would initially be left on the site, a review of the site conditions would be required every 5 years until groundwater contamination attains levels that allow for unlimited use and unrestricted exposure.

2.11.3.4 Reduction of Toxicity, Mobility, and Volume

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

- Alternative G-1 - No Action and Alternative G-2 - Limited Action - Land Use Controls and Monitoring would not provide any reduction of toxicity, mobility, and volume and neither alterative meets the statutory preference for treatment. Alternatives G-1 and G-2 may actually result in an increase in groundwater contaminant concentrations and plume migration before a steady-state condition is achieved.

- Alternative G-3 - Existing Dynamic Groundwater Collection Remediation System, Land Use Controls and Monitoring provides reduction in toxicity, mobility, and volume of OU-1 groundwater contaminants by removing/destroying contaminants in the source areas, by removing contaminants from the extracted groundwater, and by hydraulically containing plume migration. The effectiveness of the existing system has been documented by the results of the LTMP to date. Under Alternative G-3 the toxicity, mobility and volume of the residual contaminants at the site (dissolved-phase plume and residual contaminants at the source areas) will continue to be reduced by continued recovery from the collection trenches and interceptor wells; source removal/destruction actions such as the continued operation of the VER system and/or permanganate injections at Site 1; and natural attenuation. The reduction in the volume of contaminated groundwater in the aquifers of concern is also shown by the simulated reduction of contaminant plume extent. Also, based on the CDW model, there is now a reasonably estimated 30-50 year time frame to complete the cleanup. This alternative meets the statutory preference for source area treatment.

2.11.3.5 Short-Term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers and the community during construction and operation of the remedy until cleanup goals are achieved.

- Alternative G-1 - No Action, and Alternative G-2 - Limited Action-Land Use Controls and Monitoring involve no construction or site activities that would produce a disturbance to the surrounding community and environment. Therefore the level of risk to human health and the environment would remain unchanged.

- Alternative G-3 - Existing Dynamic Groundwater Remediation System, Land Use Controls, and Monitoring is already in place and also involves no construction or site activities that would produce a disturbance to the surrounding community and environment. Therefore the level of risk to human health and the environment would initially remain unchanged. Construction and/or operation activities associated with future modifications and enhancements to the existing system would include mitigation measures and a Site Specific Health and Safety Plan to minimize adverse impacts that may be posed to workers and the community.

2.11.3.6 Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other government entities are also considered.

- Alternative G-1 – No Action is technically implementable, as there are no technical barriers to doing so, even though it would not be protective of human health and the environment.

- Alternative G-2 – Limited Action-Land Use Controls and Monitoring is basically implemented as a component with the on-going Interim RA. The interceptor and monitoring wells to be included in the monitoring program have already been installed a revision to the LTMP can easily by made.

- Alternative G-3 – Existing Dynamic Groundwater Remediation System, Land Use Controls, and Monitoring is also already implemented as this is the same remedy selected in the 2000 IROD. Any future system modifications or enhancements to the existing system could be easily implemented and would most likely be done using standard construction practices and readily available equipment. Innovative technologies to optimize the groundwater remediation system would be evaluated on an ongoing basis. Personnel resources are readily available in term of Air Force support and contractor support to establish/maintain, monitor and enforce LUCs/ICs (i.e., legal and administrative controls) both on- and off-base to ensure that the remedy remains protective. However, the implementation of additional/new legal controls (if needed) for Hanscom Field and/or the conservation lands owned by the Town of Bedford will require cooperation of agencies not under the control of Hanscom AFB.

- Five-year reviews would be required for Alternative G-1 – No Action, and Alternative G-2 – Limited Action-Land Use Controls and Monitoring because contaminated groundwater would remain on the site in concentrations above levels that allow unrestricted exposure and unlimited use under each circumstance. Five-year reviews would also be required for Alternative G-3 – Existing Dynamic Groundwater Remediation System, Land Use Controls, and Monitoring until groundwater contamination is below levels that allow for unlimited use and unrestricted exposure. The technical and administrative resources for Five-Year Reviews are readily available locally.

2.11.3.7 Cost

Under the NCP, cost is a primary balancing criterion. Total present worth costs (for 30 years at a 7% discount rate) for the three alternatives for OU-1 groundwater range from negligible for Alternative G-1 – No Action to $1,032,678 for G-2 – Limited Action- Land Use Controls and Monitoring, to $7,293,522 for G-3 – Existing Dynamic Groundwater Remediation System, Land Use Controls, and Monitoring.

The total present worth costs for G-2 and G-3 include applicable capital costs, operation and maintenance costs, monitoring costs and the cost of Five-Year Reviews (for 30 years). These cost estimates also includes the Air Force's cost to implement/maintain, monitor and enforce LUCs/ICs. Please note that taking no action (Alternative G-1) would require no expenditure of money at this time. However, the site would still have to undergo the 5-year review process, at which time samples may be required to document the risk associated with the site. Estimating the potential scope of a 5 year review under no-action is outside the scope of this comparative analysis.

2.11.3.8 State / Support Agency Acceptance

The State has expressed its support for Alternative G-3 (see Appendix E). The State does not believe that Alternatives G-1 or G-2 provide adequate protection of human health and the environment.

2.11.3.9 Community Acceptance

During the public comment period, the community expressed its support for Alternative G-3. Alternatives G-1 and G-2 were not considered adequately protective.

2.12 Principal Threat Wastes

The OU-1 response action detailed in this ROD will provide protection of human health and the environment by reducing the toxicity, mobility and volume of contaminants by removing/destroying the source of groundwater contamination (i.e., DNAPL), and by containing/removing/treating the dissolved-phase groundwater contamination. The dissolved phase contamination consists of VOCs, primarily TCE, cis-1,2-DCE and vinyl chloride. The site risks associated with exposure to groundwater contamination will be also reduced through maintaining and enforcing LUCs/ICs.

The principal threats that this ROD addresses are summarized in **Table 2-10**. Principal threat wastes are those source materials considered to be highly toxic or highly mobile which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. The manner in which principal threats are addressed generally will determine whether the statutory preference for treatment as a principal element is satisfied. Wastes generally considered to be principal threats are liquid, mobile and/or highly-toxic source material.

Low-level threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. Wastes that generally are considered to be low-level threat wastes include non-mobile contaminated source material of low to moderate toxicity, surface soil containing chemicals of concern that are relatively immobile in air or ground water, low leachability contaminants or low toxicity source material. However, there are no low-level threats at OU-1.

Table 2-10 Principal and Low-level Threats

Low-level Threats	Medium	Contaminant(s)	Action To Be Taken
None at OU-1	Not applicable	Not applicable	Not applicable
Principal Threats	**Medium**	**Contaminant(s)**	**Action To Be Taken**
Human contact and ingestion	Groundwater from surficial aquifer	VOCs	Continued operation of groundwater remediation system (trenches), maintain and enforce LUCs/ICs, and monitoring
Human contact and ingestion	Groundwater from lower aquifer	VOCs	Continued operation of groundwater remediation system (IRZ and/or wells), maintain and enforce LUCs/ICs, and monitoring
Human contact and ingestion	Groundwater from bedrock aquifer	VOCs	Continued operation of groundwater remediation system (wells/VER/permanganate injections), maintain and enforce LUCs/ICs, and monitoring
Human contact with potentially contaminated source area subsurface soils	Soils in source areas	VOCs	Maintain and enforce LUCs/ICs,
Vapor Intrusion	Soils in source areas; groundwater from surficial aquifer	VOCs	Continued operation of groundwater remediation system (trenches), maintain and enforce LUCs/ICs, and monitoring

2.13 The Selected Remedy

2.13.1 Summary of the Rationale for the Selected Remedy

The selected remedy consists of continued operation of the existing dynamic groundwater remediation system, land use controls, and monitoring. The selected remedy provides for the reduction in contaminant mass and containment and reduction of the groundwater plumes. Continued operation of the dynamic groundwater remediation system will, over time, permanently eliminate the source of groundwater contamination and provide permanent aquifer restoration.

2.13.2 Description of Remedial Components

The selected remedial action includes the following:

- Existing dynamic groundwater remediation system at OU-1,
- Land Use Controls (LUCs), including Institutional Controls (ICs)
- Long-term Monitoring Program (LTMP), and
- Five-Year Reviews

2.13.3 Description of Remedial Action

The selected remedy is the outgrowth of the original groundwater remediation system specified in the 1988 Remedial Action Plans for IRP Sites 1, 2 and 3 which was constructed and became operational in 1991. The initial system consisted of groundwater collection trenches at Site 1, 2, and 3; four boundary interceptor wells aligned along a transect near Sites 1 and 2 and the northeast boundary of Hanscom Field with the conservation lands owned by the Town of Bedford; recharge basins at Sites 2 and 3; and a central treatment facility. In 1997, a Vacuum Enhanced Recovery (VER) system consisting of four recovery wells was placed in operation in the immediate vicinity of Burn Pit #1 Runoff Area at Site 1. Also in 1997, two additional conventional interceptor wells were placed in operation, one downgradient (southeast) of Site 1 (IW-6) and the other downgradient (north) of Site 2 (IW-5). In 1999, the VER system at Site 1 was augmented by the conversion of 3 monitoring wells in the immediate area to conventional interceptor wells (IW-7/8/9). Also in 1999 another conventional interceptor well was installed at the Site 1 Burn Pit #2 area (IW-10) and in 2006 a conventional interceptor well was installed midway between Site 1 and the boundary (IW-11).

All of the collected groundwater is pumped to a central treatment facility located between Sites 1 and 2, and treated water is either recharged back into the ground at Site 2 and/or Site 3 and/or discharged into a drainage channel on the east side of Runway 5-23. The drainage channel discharges into the wetlands/beaver pond area northeast of Runway 5-23. The OU-1 system has treated between 100 to 320 gallons per minute since it became operational and, as of the end of 2006, more than 1.7 billion gallons of groundwater had been treated.

In addition to the above groundwater pump and treat actions sodium permanganate has periodically been injected in the immediate vicinity of Burn Pit #1 Runoff Area at Site 1 to chemically destroy contaminants (with harmless by-products) and an in-situ reactive zone (IRZ) was created midway between Site 1 and the boundary (**Figure 7**)by the periodic injection of molasses. The injection of molasses creates suitable in-situ conditions for the biodegradation of the chlorinated aliphatic hydrocarbons which make up the OU-1 groundwater contamination.

The term "dynamic" was included in the remedy designation to reflect the Air Force's Remedial Process Optimization (RPO) Program to improve the effectiveness of on-going remedial actions. In addition to the above describe changes to the initial system the RPO process at for the OU-1 remedial action has automated the system, upgraded the pump stations at IRP Sites 1, 2 and 3 and added variable speed drives to these pumps, added flow meters for the collection system pumps, upgraded of the originally installed pumps in the 4 BIW's.

RPO is not just additions/upgrades but also includes subtractions as evidence by the suspension of groundwater collection at Site 3 in August 2001 when monitoring data indicated that groundwater contamination within the collection trench's area of influence had been reduce to the point that the groundwater met drinking water standards. Site 3 is currently in a monitoring only mode. It is expected that in the future there will be additional suspensions and/or "pulsed" operation of pumps followed by monitoring for rebounds in contaminate level within the area of influence of a collection trench/interceptor well. And, at some time in the future, as additional sections of OU-1 achieve RAOs it is expected that the size of the treatment plant will be downgraded to match the diminished incoming flows.

The above described dynamic groundwater remediation system is the selected remedy. It includes the RPO process and additional RPO initiatives are expected to be made in the future, as suggested by operational experience, monitoring and the evolution of new applicable remediation technologies. The ultimate purpose of RPO is to complete the cleanup in the most cost effective and timely manner possible. The elements of the groundwater remediation system are shown on **Figure 5** and described below. Please note that performance data for the existing dynamic groundwater remediation system is presented in Section 4.2.3 of the 2007 Revised FFS. Also note that the 2000 IROD for OU-1 identified the above described dynamic groundwater remediation system (as it existed at that time) as the selected Interim Remedial Action for OU-1 Groundwater.

Groundwater Collection Trenches and Recharge Basins

Three groundwater collection trenches were installed as part of the original remediation system. The trenches were excavated well below the water table in the surficial aquifer and a perforated collection pipe was laid along the bottom. The trenches were then backfilled with gravel. The collection pipe at each site drains by gravity to a sump, from which the collected groundwater is pumped to the central groundwater treatment facility.

The collection trench at Site 1 is a linear trench constructed the base of Hartwells Hill approximately 300-400 feet downgradient of the two fire training burn pits where contaminants were released to the ground. The trench was initially intended to intercept the flow of contaminated groundwater from each of the three aquifers. However, due to construction difficulties the trench was not installed as deep as intended and the lacustrine silt layer that separates the surficial and lower aquifers in the area where the trench was installed retards the up flow from the lower and bedrock aquifers into the trench. Consequently, much of the groundwater collected by the trench comes from the upper aquifer. Regular groundwater monitoring over the years of the Site 1 trench operation has shown that it has cleaned-up the upper aquifer and surface water downgradient of the trench and has significantly reduced levels within the trench's capture zone. However, this trench has had a lesser impact on the clean-up of the lower and bedrock aquifers.

The collection trenches at Sites 2 and 3 fully enclose areas where contaminants were released to the ground (4 drum burial pits at Site 2 and 9 of 10 drum burial pits at Site 3). Please note that former drum burial pit 3-J is approximately 250' outside the Site 3 collection trench. The collection trenches at Site 2 and 3 were intended to only recover contaminated

groundwater from the surficial aquifer, both inside and outside the enclosed areas. Regular groundwater monitoring over the years of trench operation has shown that they have performed as intended and, as noted earlier, appears to have completed the clean-up of Site 3 except for a hotspot in the vicinity of the isolated former drum burial pit (3J) outside the collection trench's area of influence. At Site 2 the collection trench has resulted in the clean-up of the upper aquifer downgradient of the trench and significantly reduced levels within the trench's capture zone.

Prior to January 1997, the each collection trench sump was equipped with fixed-rate pumps and the bulk of the collected groundwater came from Site 3 since it had the longest trench and largest pump. Also, the combined pumping capacity from the three sumps was less than the treatment plant's capacity. In January 1997, the three sumps were refitted with larger pumps and in November 1997 variable-speed controls were added to each pump. These changes allow for the operation of the treatment plant at full capacity while varying the rate of collection from the sumps. This provides the capability to prioritize collection in order of the priority of the source. Priority 1 sources are Site 1 and all interceptor/recovery wells, Priority 2 is Site 2 and Priority 3 was Site 3 before collection from the site was suspended in 2001.

To augment the natural recharge of the groundwater artificial recharge basins were constructed at the ground surface within the perimeter of the collection trenches at Site 2 and at Site 3. These recharge basins provide the means to discharge the treated/clean water and to accelerate flushing of any residual contamination from the soils above the water table. The effluent/ treated groundwater from the central treatment system is pumped through buried piping to distribution boxes at each site and then flows by gravity into a network of perforated discharge pipes laid along the original ground surface. The recharge water then seeps from the discharge pipes back into the ground until it reaches the ground water table. A mound (6-8 of clean fill) was placed over the recharge piping to protect it from freezing. Please note that this capability for on-site recharging has been used sparingly since the end of 1991 due to iron bacteria fouling of the recharge piping and its bedding material which retards the flow from the piping to the original ground surface. The distribution of the treatment system's effluent between off-site and on-site since its 1991 startup through 2006 is provided in the 2007 Revised FFS. Also note a potential future RPO initiative under consideration is to recharge at the Site 1 burn pits to accelerate the flushing of residual source to the VER system and/or the Site 1 collection trench/IW-6.

Interceptor Wells

Eleven (11) interceptor wells are presently in operation at OU-1. These include the four (4) boundary interceptor wells (BIW-1 through 4) installed along the Hanscom Field/Hanscom AFB northern property boundary with the Town of Bedford's property as components of the 1988 Remedial Action Plans for Sites 1, 2, and 3. These BIWs work together to form an elongated zone of hydraulic influence intended to serve as a barrier to offsite flow of contaminated groundwater from Sites 1, 2 and/or 3 in both the lower and bedrock aquifers.

In August 1997, two additional interceptor wells, IW-5 and IW-6, were put into operation to contain/intercept downgradient migration near the contaminant source areas as opposed to having it "pulled" to the BIWs. IW-5 has the objective of controlling the migration of

groundwater away from an area of relatively high contaminant concentrations in the lower aquifer under the Site 2 collection trench. Interception of contaminants near their source in this area is expected to eventually lead to shrinkage/cleanup of the northern part of the contaminant plume emulating from Site 2. IW-6 is on the downgradient side of the Site 1 collection trench. This is an area of relatively high contaminant concentrations and is just downgradient of the area where DNAPL was found in the bedrock aquifer. It is intended that groundwater extraction from IW-6 will isolate and/or reduce the residual DNAPL source while containing and reducing/eliminating the solute plume emulating from Site 1. However, without detailed knowledge of the extent of DNAPL presence at Site 1, this can only be confirmed by observing the response of the contaminant distribution to pumping from IW-6 over time. It should be noted that LTMP data suggests that this is in fact occurring.

In 1999, following the completion of a VER Demonstration Project in April 1999 (see following section), three of the monitoring wells installed to monitor the effectiveness of the VER demonstration were converted to interceptor wells (IW-7, 8 & 9) to increase the quantity of DNAPL and/or groundwater with extremely high VOCs concentrations being removed from this Site 1 source area (former Burn Pit #1 and the Burn Pit #1 Runoff Area.). Details of the VER area are shown on **Figure 6.** Also please note that these 3 IWs have only been operated sporadically since 1999 due to low yield and iron bacteria fouling.

Also in 1999, IW-10 was installed in the center of Burn Pit #2 at Site 1 (see **Figure 2**). While Burn Pit #2 is on the same Hartwells Hill plateau that Burn Pit #1 is on, it is ~ 170' southwest and not considered to be in the VER system capture zone. IW-10 has the purpose of capturing any residual contamination at the source areas as opposed to having it "pulled" to and captured by the downgradient collection trench, IW-6 or the BIWs.

In June 2006, a monitoring well (IRZ-2) associated with the 2000-2002 DoD Demonstration Project to create an in-situ reactive zone (IRZ) by the periodic injections of the molasses was converted to a conventional interceptor well (IW-11). This well is believed to be located near the center of the Site 1 on-site plume and is shown on **Figure 5.** The purpose of IW-11 is to intercept/recover residual groundwater contamination and complete the cleanup of the IRZ area. Please note that the DoD Demonstration Project is discussed in a following section and that the LTMP data for demonstration project area indicates that there continues to be a lingering positive effect from the IRZ created by the 2000-2002 injections of molasses and that most of the upgradient TCE has been/is being biodegraded near the injection well, leaving cis-1,2-DCE as the predominate contaminant remaining in the upgradient area.

Vacuum Enhanced Recovery (VER) System/Permanganate Injection

In October 1997, a VER system was installed upgradient of the Site 1 collection trench in the vicinity of Burn Pit #1 and the Burn Pit #1 Runoff Area (**Figure 6**). The VOC concentrations are high in this area and DNAPL has been found in Monitoring Well RAP1-3R in the past. The VER system consists of four extraction wells completed into the bedrock. The four wells are arranged at the corners of a square approximately 40-feet on a side. Vacuum lines connect the wells to a vacuum pump that can pump both liquids and gases. By applying a vacuum in the aquifer, these wells increase the inward flow of groundwater and accelerate flow to the wells. The liquids produced are potentially both contaminated groundwater and

the non-aqueous source liquids. These are pumped through buried piping and discharge into the Site 1 collection trench sump for further pumping to the OU-1 groundwater treatment plant. In addition, the vacuum induces air flow and volatilization in the dewatered bedrock factures which permits remediation to continue even when the aquifer has been substantially de-watered. The vapors recovered are routed through activated carbon units for removal of the VOCs prior to discharge to the atmosphere. These units are monitored to ensure that at least 95% of the volatile contaminants are removed. The carbon is either replaced or regenerated on-site whenever monitoring indicates that the efficiency of the carbon is approaching regulatory limits.

The VER system was originally installed as a Technology Transfer Demonstration Project. This project operated for two 6-month periods between October 1997 and April 1999. This demonstration was very successful in removing contaminant mass from the bedrock. So successful that, following completion of the demonstration project, the system was incorporated in the existing OU-1 groundwater remediation system. When operating the four VER wells recover liquids at a total rate of approximately 1-2 gpm.

On 18-June 2001 the operation of the VER system was suspended for the duration of a permanganate pilot study in the same area. The objective of this pilot study was to determine if permanganate injection/in-situ oxidation would be more effective than the VER system as a technology to use to clean up this source area. The field phase of the pilot study was completed in the fall of 2002 and it was concluded that both technologies were effective but that VER has a short-term advantage, due to its ability to actively draw the contamination to the recovery wells and the fact that the system was already in-place. It was also concluded that periodic permanganate injections should also be incorporated in the remediation strategy. Subsequently, operation of the VER System re-commenced on 10-October 2002. Initially on a part-time basis and then full-time/around-the clock on 24-December 2002. Operation of the VER system continued until 31-July 2006 (except for maintenance and repair periods). On 31-July 2006 operation of the VER system was again suspended for the duration of a permanganate treatment of the same area. It is anticipated that the alternating periods of VER and permanganate treatments will continue at this Site 1 source area as long as significant contaminant mass is being removed and/or destroyed.

Molasses Injection

In 2000 a DoD Environmental Security Technology Certification Program (ESTCP) project entitled: In-situ Substrate Addition to Create Reactive Zones for Treatment of Chlorinated Aliphatic Hydrocarbons: Hanscom AFB was conducted in the vicinity of the RAP1-6 monitoring well cluster which is considered to be in the heart of the on-site plume emanating from Site 1 (see **Figure 2-7**). This project involved multiple injections of a substrate (molasses) into a lower aquifer injection well located ~ 50 feet upgradient of the existing RAP1-6 monitoring well cluster. A total of forty-seven injections were made between October 2000 and October 2002. Over this time 1,250 gallons of raw blackstrap molasses was injected (average of 139 lbs molasses/ week). 5 additional lower aquifer monitoring wells were also installed in this section of the Site 1 plume to monitor the effects of the molasses injections. The RAP1-6 area was selected because lower and bedrock aquifer contaminant levels were still high and conditions in the lower aquifer were not considered conducive to the natural biodegradation of the groundwater contamination. The LTMP

results for the IRZ area also showed that, prior to the commencement of molasses injections, the cleanup the lower and bedrock aquifers was progressing at a very slow pace. Since the last molasses injection in 2002 there has been a dramatic change in that both the TCE and cis-1,2-DCE concentrations in the lower aquifer dropped rapidly to the point that they join the upper aquifer as below MCLs. Concentrations of both contaminants in the bedrock aquifer have also declined significantly but still have a way to go. The drop in the TCE concentration in the lower aquifer (RAP1-6T & IRZ-1) after injections began in 2000 was initially considered a "localized" (or short term) effect of the injections. This conclusion was supported at that time by the relatively stable concentrations in the downgradient lower aquifer monitoring wells IRZ-2, IRZ-3, IRZ-4 and IRZ-5. In fact, as the effects of the injections wore off, the expected rebound in contaminant levels did occur at both RAP1-6T and IRZ-1. However, the recent LTMP data now shows both a delayed and a lingering positive effect. It appears that the lower aquifer IRZ created by the 2000-2002 injections of molasses continues to be productive. Also, since 2003, the TCE and cis-1,2-DCE concentrations in the other/downgradient IRZ monitoring wells are in a definitive downtrend which is also an indication that the IRZ continues to be productive. At the injection well (IRZ-Inj) an interesting/unique pattern has developed. As expected the TCE and cis-1,2-DCE concentrations dropped precipitously, and rapidly, during the active injection phase. Following the last injection, the cis-1,2-DCE initially rebounded to pre-injection levels, but is now in a definitive downtrend. However, the TCE has never rebounded. It has remained at very low to below detection levels since January 2001. It appears that the groundwater flowing into the IRZ area is either no longer contaminated or, if contaminated, all of the TCE in it has biodegraded by the time it reaches injection well. The declining cis-1,2-DCE concentrations are also an indication that the overall levels of groundwater contamination flowing into the IRZ area is declining which supports the hypothesis that the Site 1 collection trench augmented by IW-6 in 1997 has been effective in capturing/containing the plume (upper, lower and bedrock aquifers) flowing away from the source areas towards BIW-3 and BIW-4.

The molasses injection equipment remains on site and the injection well remains in place. Thus additional molasses injections to "refresh" the residual IRZ can be readily made in the future if LTMP results indicate that such would be beneficial. This action would be considered a component of the "dynamic" groundwater remediation system and undertaken as a RPO measure.

Groundwater Treatment

All of the groundwater collected by the elements described above is pumped to a central groundwater treatment plant. The maximum designed flow capacity of the treatment plant is approximately 320 gallons per minute (gpm). The plant location is shown on **Figure 5**. The groundwater is pumped through two air stripping towers in series to remove volatile compounds. The water cascades from the top down through materials within the towers while air is blown upward through the water/materials. Contaminants (VOCs) are removed from the groundwater in the process and go into a gaseous phase. The treated water that leaves the towers, called effluent, is sampled and analyzed by a commercial laboratory at least monthly to ensure that it meets regulatory discharge parameters. The treated groundwater/effluent can be pumped to the recharge basins at Sites 1 and 2 and/or discharged to a drainage channel between the treatment plant and the northeast-southwest

runway of Hanscom Field. This drainage channel discharges into the wetlands in the conservation lands owned by the Town of Bedford. Between 1991 and December 2006 approximately 1.7 billion gallons of water was treated and discharged from the treatment plant. As stated above the bulk (approximately 90%) of the treated effluent has been discharged into the drainage channel because of iron bacteria fouling the recharge basins.

The air that is blown through the stripping towers is passed through two activated carbon units in series to remove the volatile contaminants in the air prior to discharge to the atmosphere. These units are monitored continuously to ensure that at least 95% of the volatile contaminants are removed. The treatment plant also includes a steam boiler and chiller for the regeneration of the carbon units whenever monitoring indicates that the efficiency of the carbon is approaching regulatory limits.

Land Use Controls

LUCs/ICs include legal, physical, or administrative mechanisms that restrict the use of, or limit access to, real property to prevent or reduce risks to human health and the environment. The objectives of the Hanscom AFB LUCs are to prevent exposure to, and use of, contaminated groundwater until cleanup levels are met, ensure that excavation at the three source areas (IRP Sites 1, 2 and 3) is controlled to prevent exposure to any residual contamination in the subsurface soil, and prevent exposure to vapors that could accumulate in buildings effected by the contaminated groundwater plume. The risks that necessitated these LUCs are discussed in Section 2.7 of this ROD.

The potential for residual soil contamination is limited to the actual Burn Pits (#1 and #2) and the Burn Pit 1 Runoff Area at IRP Site 1 (see **Figure 2)** and the drum burial pits at IRP Sites 2 and 3 (see **Figures 3 and 4**). OU-1 contaminated groundwater is located on Hanscom Field, in the Hanscom AFB's Family Campground, and in the lower and/or bedrock aquifers off-site in the Hartwell Town Forest/Jordan Conservation Area. Figures 10, 11 and 12 of this ROD show the locations of all VOCs detections in the November 2006 LTM event and Figures 4-2 & 4-5 in Appendix F shows the "modeled" extent of the lower aquifer and the bedrock aquifer respectively based on 2005 LTM data. Since the 2007 Focused Groundwater Flow and Transport model was calibrated using both 1997 and 2005 LTM data the modeled 2005 plumes are consider to be an accurate depiction of the actual plumes in the lower and bedrock aquifers. Also, while the property line and other mapping features are not shown on these figures, the three cones of depression in groundwater elevations associated with the boundary interceptor wells can be used to define boundary.

On-Site LUCs

Hanscom AFB LUCs/ICs are primarily documented in the November 2003 Hanscom AFB General Plan Update (master plan). The General Plan Update includes specific environmental constraints that apply to all IRP Sites with LUCs and/or ICs as a component of the selected remedy, including OU-1. The Update also includes constraints in regards to closed IRP Sites. Section 2.7 of this document, entitled *Responsibilities*, states as follows:

The following are general responsibilities identified throughout the General Plan Update document. These are significant responsibilities that need to be brought to the attention of the Commander and users of the Plan to provide that they are implemented.

Ground Disturbance
Since the 1998 General Plan, several Installation Restoration Program (IRP) (now called Environmental Restoration Program, ERP) sites have been remediated (see section 4.3.3.) Any ground disturbance on the remediated sites still must be reviewed and approved by the Hanscom AFB Environmental Office before any digging begins to provide that adequate precautions are taken to mitigate risks.

Land Use Changes at ERP Sites
No changes in the current land use of the (ERP) site can be made without the written approval of the USAF government oversight Environmental Office. Also EPA and MADEP are to be notified for consultation 45 days in advance of any proposed land use changes which are inconsistent with the land use assumptions or land uses described in the remedy selection document.

Specific LUCs found in Section 4.3.3.3 of the General Plan Update that apply to all Hanscom AFB IRP Sites, including OU-1, prohibit the installation and operation of drinking water wells and the use of untreated contaminated groundwater for any purpose. In addition, this Section of the Update requires that any digging, excavation or groundwater use on the Site be approved by the Base Environmental Office in writing. Once approved, the activities must be conducted in accordance with all appropriate OSHA requirements, including a site-specific health and safety plan.

Additionally, Hanscom AFB operating procedures as defined by Air Force Instructions (AFIs) require that project planning documents (for both new construction and repair projects) be coordinated with the environmental office and be evaluated for environmental impacts in accordance with the Air Force Environmental Impact Analysis Process (EIAP)/the National Environmental Policy Act of 1969 (NEPA). The Air Force will notify EPA 45 days in advance of any changes to either the AFIs or the General Plan Update that could affect the LUCs.

As discussed in Section 2.1.4 above, Hanscom Field is owned by the Commonwealth of Massachusetts and operated by the Massachusetts Port Authority (Massport) and the Federal Aviation Administration (FAA). However, Hanscom Field was leased from the Commonwealth and used as a military airport by the Air Force from 1942 to 1973. Since the early 1980s, Massport has granted the Air Force's personnel and contractors access to Hanscom Field for projects associated with the Hanscom AFB IRP. This access is formalized by License Agreements with the current license scheduled for renewal in September 2007. Given the fact that Massport's 2005 ESPR includes forecasts for 2010 and 2020 scenarios which indicate that Hanscom Field will continue to be a full-service General Aviation airport, it is unlikely that the current use of this area will change in the foreseeable future.

As the owner of this area, Massport is kept up-to-date on the status of the Hanscom AFB IRP. Both the Airport Director and Massport's Environmental Unit are on the distribution list for IRP Reports concerning OU-1 (and other IRP Reports concerning/affecting Hanscom Field). Massport is also a chartered member of the Hanscom AFB Restoration Advisory Board (RAB). In addition, Massport's operational personnel, planners, and decision makers are made aware of the presence of on-base contamination, OU-1 and the locations of IRP Sites 1, 2 and 3 in Figure 9-4 of Massport's 2005 L.G. Hanscom Field Environmental Status and Planning Report (ESPR). Chapter 9 of the document includes a discussion of the Hanscom AFB IRP.

As an additional protective measure, any proposed major project, e.g., new runways, hangers or expansion of existing structures, projects that directly alter 25 or more acres of land or create 5 or more acres of impervious area would be subject to review under the Massachusetts Environmental Policy Act (MEPA) and/or the National Environmental Policy Act of 1969 (NEPA). As acknowledged by Massport's 2005 ESPR, "the ESPR does not replace the MEPA reviews of project at the sites which exceed regulatory thresholds."

Several physical barriers also restrict exposure to contamination at OU-1. Hanscom Field has a perimeter fence and all areas of Hanscom Field are patrolled by security forces. Access to the field is controlled and restricted to authorized personnel. In addition, IRP Site 1 is separately fenced.

Construction of the OU-1 recharge basins placed 6-8 feet of clean soil over the original ground surface of the waste burial pits at IRP Sites 2 and 3. All visually contaminated soil at IRP sites 1, 2 and 3 was removed by the 1988 removal actions and replaced by clean backfill. As a result, access to any residual subsurface soil contamination is physically restricted by a 6-8 foot soil barrier.

IRP Sites 1, 2 and 3 are immediately adjacent to the runways and are within the restrictive airfield area. Due to airfield operational constraints the only digging in the vicinity of these IRP sites by Massport that could be envisioned would be for the repair or installation of underground utilities or storm drainage structures. Further, in place remedial system piping and recharge basins at Site 2 and 3 would necessitate routing of new utility services or storm drainage around the area with any residual subsurface soil contamination. If construction activities are planned for the airfield area in the future, appropriate health and safety procedures will be followed, including the preparation of a site specific health and safety procedures in accordance with OSHA (29 CFR 1910.120) and all other applicable federal, state, and local requirements.

Groundwater beneath OU-1 is not used and is not expected to ever be used as a public water supply. The public water supply for Hanscom Field is provided by Lexington (served by MWRA) and the Hanscom AFB's Family Campground is provided by Bedford (served by MWRA and wells). Also there are no structures off-site in the Hartwell Town Forest/Jordan Conservation Area. Figure 9-2 of Massport's 2005 ESPR shows all public water supply facilities within Bedford, Concord, Lexington and Lincoln. Table 9-4 shows the approximate distance of each from Hanscom Field which vary from 0.9 to 7.3 miles. Figure 9-2 of Massport's 2005 ESPR (which is the same as Figure 16 of this ROD) delineates

an approved Zone II Wellhead Protection Area that overlaps the section of Hanscom Field that includes IRP Site 3. These areas are approved under the MADEP's Drinking Water Program to protect the recharge area around public water supply groundwater sources.

The Air Force shall not modify or terminate LUCs, implementation actions, or modify land use without approval by EPA and the Commonwealth. The Air Force shall seek prior concurrence before any anticipation action that may disrupt the effectiveness of the LUCs or any action that may alter or negate the need for LUCs.

Off-Site LUCs

In addition to the Hanscom Field and Hanscom AFB's Family Campground areas, the contaminated plume migrates off-base into conservation lands owned by the Town of Bedford. This area of OU-1 includes undeveloped wetlands, beaver ponds and forest areas known as the Jordan Conservation Area and Hartwell Town Forest. For those portions of OU-1 located on conservation lands owned by the Town of Bedford, a legal mechanism in the form of deed restrictions are in place which limit the use of this property to passive and/or recreational use. These restrictions are summarized in the July 27, 2007 Conservation Commission letter included as Appendix G.

Town of Bedford officials are kept up-to-date on the status of the Hanscom AFB IRP and levels of contaminants in the groundwater beneath the town owned land. The Board of Health is furnished a copy of all OU-1 LTM Reports and both the Board of Health and Conservation Commission are on the distribution list for the monthly Remedial Action Report. Also the Board of Health Director is a chartered member of the Hanscom AFB Restoration Advisory Board (RAB) and the Chair of the Boars periodically attends RAB meetings.

The Air Force, in consultation with the EPA and Mass DEP, will attempt to establish restrictions prohibiting the construction of wells and the use of groundwater in any documented or anticipated area of groundwater contamination. These restrictions shall be in place within 1 year of the ROD's signature. In the event that such restrictions are not established, EPA, Mass DEP, and the Air Force will determine what alternative measures should be taken to prohibit exposure to contaminated groundwater in off-base areas.

On- and off-site LUCs will be maintained until the concentrations of hazardous substances in the soil and groundwater are at such levels to allow for unrestricted use and exposure. The Air Force is responsible for ensuring that the LUCs described above, as components of the selected remedy, continue to be in place, are reported on, and enforced to ensure that the LUCs are effective and protective of human health and the environment. In this regard, the Hanscom AFB environmental office will formally monitor and document the results in normal operations, maintenance, and/or monitoring reports of the remedial action. This monitoring will be accomplished by:

- Frequent inspections (almost daily) of the OU-1 area by the Hanscom AFB's remedial action-operations contractor's on-site staff in the course of their OU-1 system operation, maintenance and monitoring duties, and

- Discussions at least annually, or more often if warranted between Massport and Bedford officials and the Hanscom AFB IRP Manager to verify that untreated groundwater within OU-1 is not being used for any purpose, and that there is no unauthorized digging at IRP Sites 1, 2 and 3.

The monitoring results will be included in a separate annual report or as a section of another annual environmental report, if appropriate, and provided to the EPA and the Commonwealth. The annual monitoring reports will be used in preparation of the Five Year Reviews to evaluate the effectiveness of the OU-1 remedy.

The annual monitoring report, submitted to the regulatory agencies by the Air Force, will evaluate the status of the ICs and show how any IC deficiencies or inconsistent uses have been addressed. The annual evaluation will address whether the use restrictions and controls referenced above were communicated, whether the owners and state and local agencies were notified of the use restrictions and controls affecting the property, and whether use of the property has conformed to such restrictions and controls.

The discovery of any activity that is inconsistent with the LUC objectives or use restrictions, or any other action that may interfere with the effectiveness of the ICs will be addressed by the Air Force as soon as practicable, but in no case will the process be initiated later than ten days after the Air Force becomes aware of the breach. In addition, the Air Force will notify EPA and the Commonwealth as soon as practicable but no longer than ten days after the discovery of any activity that is inconsistent with the IC objectives or use restrictions, or any other action that my interfere with the effectiveness of the ICs. The Air Force will notify EPA and the Commonwealth regarding how the Air Force has addressed or will address the breach within ten days of sending EPA and the Commonwealth notification of the breach.

The Air Force shall notify EPA and the Commonwealth 45 days in advance of any proposed land use changes that are inconsistent with land use objectives or the selected remedy. Should the Air Force plan on transferring or leasing any property affected by OU-1, whether or not as a result of base closure, the Air Force will consult with USEPA and MADEP at least six months in advance so that EPA and the Commonwealth can be involved in discussions to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective ICs. If it is not possible for the Air Force to notify EPA and the Commonwealth at least six months prior to any transfer or sale, then the Air Force will notify EPA and the Commonwealth as soon as possible but no later than 60 days prior to the transfer or sale on any property subject to ICs. In addition to the land transfer notice and discussion provisions above, the Air Force further agrees to provide EPA and the Commonwealth with similar notice, within the same time frames, as to federal-to-federal transfers of property. The Air Force shall provide a copy of the executed deed or transfer assembly to EPA and the Commonwealth.

Monitoring

This remedy includes the continuation of groundwater and surface water monitoring at OU-1 and the LTMP sampling points are shown on **Figure 9**. The post-1998 LTMP for OU-1 has been 2-phased; (1) the annual sampling of selected monitoring wells and a surface water sampling point for analysis of VOCs by an off-site commercial laboratory, and (2) the

monthly/ quarterly/semi-annually/annually sampling of collection points, selected monitoring and the surface water sampling point for analysis by the O&M staff using an on-site gas chromatograph (GC). Please note the analysis with the on-site GC only quantifies the two principal contaminants of concern, TCE and Cis-1,2-DCE. The LTMP has also been subject to the RPO process in that sampling points and frequency are re-evaluated after each round for changes necessary to more effectively accomplish the objectives of LTMP.

The LTMP component of the remedy continues the two-phase approach. Phase 1 is the annual sampling of selected wells to confirm established LTM trends within the OU-1 source areas and plumes and to monitor progress towards achievement of RAOs. Analysis of these samples will be for VOCs by an off-site commercial laboratory. The Phase 1 sampling and analysis will continue to be documented in a formal LTM Report. The second phase of the LTMP is the sampling of collection sources and monitoring wells for screening by the operations and maintenance (O&M) staff using an on-site GC. The purpose of this sampling and analysis is for system optimization (RPO) and to identify any changes in the established LTM TCE and cis-1,2-DCE trends. Results of the LTMP Phase 2 sampling and analysis will continue to be documented in the Monthly OU-1 Remedial Action Report which is submitted to USEPA Region I, MADEP and stakeholders.

The interceptor/ recovery, monitoring wells and surface water monitoring points to be included in the LTMP for this remedy were are listed in **Table 2-11**. This LTMP includes the laboratory analysis of fewer samples (34) than Alternative G-2, but when combined with the on-site GC analysis will provide more data to assess the effectiveness of the remedial effort and progress towards attainment of RAOs and the complete cleanup of OU-1.

The monitoring wells and surface water monitoring point to be included in Phase 1 of the LTMP for this alternative were selected based upon their geographical location, screened aquifer, and historical contaminant levels/trends. Selected monitoring points include wells for the upper, lower, and bedrock aquifers in the following geographic areas of the site.

- within the known OU-1 source areas to assess any potential changes in contaminant concentrations in these source areas,
- the downgradient portion of on-site contaminant plumes,
- wells along the boundary of Hanscom Field/Hanscom AFB with the conservation lands owned by the Town of Bedford,
- wells in the conservation lands owned by the Town of Bedford/off-site OU-1 plume, and
- on-site surface monitoring point RAP1-SW4 to continue to document that the water quality in the Wetland B/Beaver Pond Area is no longer being impacted by contaminated groundwater migrating from the upper Aquifer.

Please note the LTMP will continue to be subject to the RPO process in that the sampling points and frequency are re-evaluated after each event for changes necessary to more effectively accomplish the objectives of LTMP.

Table 2-11 Alternative G-3 - Existing Dynamic Groundwater Remediation System, Land Use Controls and Monitoring

Long-Term Monitoring Program (LTMP)

GW Remediation System	GC	LAB
AS INFLUENT	W	M
AS MID	W	
AS EFFLUENT	W	M
P101	M	
P201	M	
P301	M	
IW-1	M	
IW-2	M	
IW-3	M	
IW-4	M	
IW-5	M	
IW-6	M	
IW-7 (GM MW2)	M	
IW-8 (GM MW3)	M	
IW-9 (GM MW4)	M	
IW-10	M	
IW-11	M	
VER-1	M	
VER-2	M	
VER-3	M	
VER-4	M	
VER EFFLUENT	M	
CT Cleanouts	AR	

	GC	LAB
Suspended		
Weekly	3	
Monthly	19	2
As Requested	tbd	

SITE 1 SURFACE	GC	LAB
A-4	Su	
B104	Su	
B238	A	
B241	A	
PO1-4SA	A	
RAP 1-3S	**Q**	
RAP 1-5S	A	
RAP 1-6S	**Q**	A
RAP 1-SW4	**Q**	A
RAP 2-2S *	**Q**	
RFW-15	Su	
SITE 1 LOWER		
B103	A	
B239	**Q**	
B242	**Q**	A
CW-4	A	
PT1-SA	A	
RAP 1-6T	**Q**	A
RAP 2-2T *	**Q**	A
V1	**Q**	
IRZ-Inj	Q	
IRZ-1	Q	
IRZ-3	Q	
IRZ-4	Q	
IRZ-5	Q	
SITE 1 BEDROCK		
A-3	Su	
B237	**Q**	
B240	**Q**	
B243	**Q**	A
GM MW1	**Q**	
RAP 1-2R	A	
RAP 1-3R	**Q**	A
RAP 1-5R	**Q**	
RAP 1-6R	**Q**	A
RAP 2-2R *	**Q**	A

	GC	LAB
Suspended	4	
Quarterly	22	
Semi-Annually		
Annually	8	9
As Requested	tbd	

* Considered to be w/in Site 1 Plume

SITE 2 SURFACE	GC	LAB
OW2-1	**Q**	
OW2-2	**Q**	
OW2-3	**Q**	
OW2-4	**Q**	
OW2-5	**Q**	
OW2-6	**Q**	
OW2-7	**Q**	
OW2-8	**Q**	
RAP 2-4S *	Su	
RAP 2-5S	Su	
B101	**Q**	
B105	**Q**	
B106	A	
B107	**Q**	
B130	Su	
PO2-1S	**Q**	
RFW-11	**Q**	A
SITE 2 LOWER		
B108 *	**Q**	A
B109	**Q**	
B110	Su	
B112	Su	
B113 *	**Q**	
B114 *	A	
B115	**Q**	A
RAP 2-4T *	Su	
RAP 2-5T	Su	
RAP 2-6T	Su	
SITE 2 BEDROCK		
RAP 2-4R *	Su	
RAP 2-5R	Su	
RAP 2-6R	Su	

	GC	LAB
Suspended	11	
Quarterly	17	
Semi-Annually		
Annually	2	3
As Requested	tbd	

BOUNDARY/FOREST SURFACE	GC	LAB
B102	Su	
B127	Su	
B128	Su	
B129	Su	
B246	Su	
B247	Su	
B250	Su	
B253	Su	
PO1-2S	Su	
RAP 1-4S	Su	
RAP 1-7S	S	
RAP 2-1S	Su	
RAP 2-3S	Su	
BOUNDARY/FOREST LOWER		
B111	S	A
B126	S	A
B245	S	A
B248	S	A
B251	S	A
B254	S	A
PO2-1T	S	
PO2-2T	S	
RAP 1-1T	S	
RAP 1-7T	S	A
RAP2-1T	S	A
RAP 2-3T	S	A
BOUNDARY/FOREST BEDROCK		
B244A	S	A
B249	S	
B252	S	
B255	S	
PO1-2R	S	A
PO2-1RA	S	
PO2-2R	S	
PT1-RA	S	A
PT2-RA	S	
RAP 1-1R	S	
RAP 1-4RA	S	
RAP 1-7R	S	A
RAP2-1R	S	A
RAP 2-3R	S	

	GC	LAB
Suspended	12	
Quarterly		
Semi-Annually	27	
Annually		14
As Requested	tbd	

SITE 3 SURFACE	GC	LAB
A-1	Su	
B116	A	
B117	**Q**	A
B118	**Q**	A
B119	Su	
B120	Su	
OW3-1	Su	
OW3-2	Su	
OW3-3	A	
OW3-4	A	
OW3-5	A	
OW3-6	A	
OW3-7	A	
OW3-8	Su	
OW3-9	Su	
OW3-10	A	
OW3-11	A	
OW3-12	A	
OW3-13	A	
OW3-14	**Q**	A
RAP3-3S	**Q**	A
SITE 3 LOWER		
A-5	Su	
B121	A	
B122	**Q**	A
B123	Su	
B125	**Q**	A
HAFB2	Su	
HAFB3	Su	
RAP3-3T	A	
SITE 3 BEDROCK		
A2	Su	
B124	Su	
B231	A	
B232	**Q**	A

	GC	LAB
Suspended	13	
Quarterly	7	
Semi-Annually		
Annually	13	7
As Requested	tbd	

AIRFIELD SURFACE	GC	LAB
B234	Su	
B235	Su	
CW-6A	Su	
RAP3-1S	Su	
RAP3-4S	**Q**	A
RAP5-2S	Su	
AIRFIELD LOWER		
B233	Su	
B236	Su	
CW5	Su	
CW-6	Su	
RAP3-1T	Su	
RAP3-4T	Su	
RAP5-1T	Su	
RAP5-2T	Su	
AIRFIELD BEDROCK		
RAP5-1R	Su	
RAP5-2R	Su	
NORTHWEST AREA		
BR-1 (R)	Su	
CW-2 (R)	Su	
CW-3 (T)	Su	
CW-3A (S)	Su	
CW-19 (T)	Su	
CW-20 (T/R)	Su	
CW-20A (S)	Su	
HAFB-7 (L?)	Su	

	GC	LAB
Suspended	23	
Quarterly	1	
Semi-Annually		
Annually		1
As Requested	tbd	

SCHEDULE	C	S	MW	
JAN	12	19	8	S3 + AF/NW (Q)
FEB	12	19	0	
MAR	12	19	39	S1 (Q) & S2 (Q)
APR	12	19	8	S3 + AF/NW (Q)
MAY	12	19	27	B/F(S)
JUN	12	19	49	S1 (A) & S2 (A)
JUL	12	19	8	S3 + AF/NW (Q)
AUG	12	19	0	
SEP	12	19	39	S1 (Q) & S2 (Q)
OCT	12	19	21	S3 + AF/NW (A)
NOV	12	19	47	B/F (A)+ Lab Annuals
DEC	12	19	39	S1 (Q) & S2 (Q)
5th Wk	12			
	156	228	285	TOTAL

47	Q1
84	Q2
47	Q3
107	Q4
285	TOTAL

SUMMARY	GC	LAB
Suspended	63	
WEEKLY	3	0
MONTHLY	19	2
QUARTERLY	47	0
SEMI-A	27	0
ANNUALLY	23	34
PE for 8260		1
QA/QC Samples		12
As Requested	tbd	tbd

LEGEND

QU1 = Operable Unit 1
LTM Plan = Long Term Monitoring Plan
GC = Analysis by on-site Gas Chromatograph
LAB = Analysis by Commerical Laboratory
tbd = to be determined
C = Compliance (Influent, midpoint & effluent)
S =Collection System/Sources
MW = Monitoring Wells
(A) = Annual
(S) = Semi-Annual
(Q) = Quarterly
(Su) = Suspended based on historical results
S1 = Site 1
S2 = Site 2
S3 = Site 3
B/F = Boundary/Forest Area
AF = Airfield Area Between Site 3 and Sites 1& 2
NW = Northwest Area
S = Surface Aquifer
L = Lower Aquifer
BR = Bedrock Aquifer

Notes:
Groundwater elevation recorded at each sampling, also when requested by site/aquifer
Elevation for RAP1-SW4 taken @ PZ202

Five-Year Reviews

To the extent required by law, the USAF will review the site at least once every five years after the initiation of remedial action at the site if any hazardous substances, pollutants or contaminants remain at the site (above levels that allow for unlimited use and unrestricted exposure) to assure that the remedial action continues to protect human health and the environment.

2.13.4 Summary of the Estimated Remedy Costs

A table detailing the selected remedy cost is presented in Appendix C. This remedy includes the continued operation of the existing dynamic groundwater remediation system in its current configuration with the potential for future optimization initiatives as appropriate. This remedy also includes the continuation of the existing LTMP. The monitoring program includes sampling of existing interceptor and groundwater monitoring wells with an analytical screening by a field GC unit in addition to the sampling of 33 existing monitoring wells and one surface water location for offsite VOC analysis. There is no capital cost associated with this alternative in its current configuration, because no new interceptor or monitoring wells will need to be installed. However, this cost estimate does include an annual lump sum amount for major repairs and/or future improvements or enhancements to the remediation system. This cost estimate also includes the Air Force's cost to implement/maintain, monitor and enforce LUCs/ICs. The total annual operation, maintenance, and monitoring costs will be approximately $545,244 and 5-Year Reviews are estimated to cost $25,000 each. The duration of the remedial action period will depend upon whether or not cleanup progresses faster or slower than the 30-50 years predicted by the current conservative model. It is anticipated that it will be faster since the model assumes no biodegration, whereas LTMP data does indicate that such is occurring. However, for comparative purposes, it has been assumed that the remedial action would be continued for 30 years with six 5-Year Reviews. The present worth for this alternative, based on a 7 percent discount rate, is $7,293,522. Please note that the cost estimate also assumes a constant level of operation, maintenance, and monitoring throughout the 30-years with no reductions for the anticipated RPO actions.

The cost estimate summary table is based on the best available information (records of past operational costs) regarding the selected remedy. Changes in the cost elements are likely to occur as a result of a new contracting method (scheduled to be implemented in February 2008) and reductions due to additional RPO initiatives. Major changes may be documented in the form of a memorandum in the Administrative Record file, an Explanation of Significant Differences (ESD), or in an amendment to this final ROD. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

2.13.5 Expected Outcomes of the Selected Remedy

The primary outcome of the selected remedy is that the human health risks associated with the contaminated groundwater at the site will be eliminated through the implementation of the selected remedy described above. In the interim exposure to contaminants will be controlled through the use of LUCs until contaminant concentrations are reduced to levels which allow for unlimited and unrestricted use. Continued operation of the dynamic groundwater remediation system will contain and reduce the concentration of the

groundwater contaminant plumes, prevent contaminated groundwater discharges to surface water, and, over time, permanently eliminate the source of groundwater contamination and provide permanent aquifer restoration. Surface water and groundwater sampling and analysis as part of the LTMP will confirm the effectiveness of the remedy in achieving RAOs.

As discussed in Section 2.6 the potential future land and resources uses of the OU-1 area (sections of Hanscom Field/Hanscom AFB and conservation lands owned by the Town of Bedford) are expected to remain as the current use. However, upon achieving clean-up levels in 30-50 years the groundwater within OU-1 will be available for drinking water use and the contaminant source areas (IRP Sites 1, 2 and 3) will be available for additional Hanscom Field infrastructure (subject to FAA restrictions). In addition, since the potential for surface water contamination will be eliminated, there will be an enhanced recreational/ human use of the ecological resources and an enhanced ecological benefit to sensitive ecosystems within the OU-1 area.

2.13.5.1 Cleanup Levels

Groundwater cleanup levels have been established for all COCs in groundwater determined to pose an unacceptable risk to either public health or the environment. These cleanup levels have been set based on the chemical-specific ARARs for OU-1, i.e., federal drinking water standards (i.e., MCLs and non-zero MCLGs), state drinking water standards (i.e., MCLs) and state groundwater risk characterization standards (i.e., MCP Method 1 GW-1 standards). **Table 2-12** summarizes the cleanup levels for carcinogenic and non-carcinogenic COCs in groundwater. These cleanup levels were selected since the groundwater beneath and directly downgradient to OU-1, and beneath and directly downgradient to the Hanscom AFB/Hanscom Field NPL Site as a whole, has been designated as GW-1 (i.e., as a potential future drinking water supply) under state law by means of a Town of Bedford Aquifer Protection District by-law that was enacted through a process authorized by and implementing the MCP. In addition, MADEP has classified the eastern side of OU-1, east of Runway 5-23, as an approved Zone II; under the state drinking water regulations (310 CMR 22.02), a Zone II is "that area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated." Further in addition, the northeastern portion of the site at the northern end of Runway 5-23 is classified as a Potentially Productive Aquifer; the MCP defines "Potentially Productive Aquifer" in part as "all aquifers delineated by the U.S. Geological Survey (USGS) as a high or medium yield aquifer." The MADEP Site Scoring Map reflecting these areas is included as **Figure 16**.

MCLs shall constitute the final groundwater cleanup levels for this ROD. Newly promulgated ARARs and modified ARARs which call into question the protectiveness of the remedy and the protective levels determined as a consequence of the risk assessment of residual contamination, also must be met at the completion of the remedial action. At OU-1 cleanup levels will be met in groundwater throughout the site and will be demonstrated through monitoring. USAF has estimated that the cleanup levels will be obtained between 30 and 50 years after the selected remedy is put in place.

Table 2-12: Remediation Goals for NPL OU-1, Hanscom Field/Hanscom AFB, MA

Contaminants of Potential Concern (COPCs) *	MCP GW-1 Standard	MCP GW-2 Standard	MCP GW-3 Standard	EPA MCL
Organic Compounds (ug/L)				
1,1-Dichloroethane	70	1,000	20,000	NA
1,1-Dichloroethene	7	80	30,000	7
1,1,1-Trichloroethane	200	4,000	20,000	200
1,2-Dichlorobenzene	600	2,000	2,000	600
1,2-Dichloroethane	5	5	20,000	5
Acetone	3,000	50,000	50,000	NA
Benzene	5	2,000	10,000	5
Chloroethane	NA	NA	NA	NA
Chloroform	5	400	10,000	100
cis-1,2-Dichloroethene	70	100	50,000	70
Methyl-tert-butyl-ether (MTBE)	70	50,000	50,000	NA
Toluene	1,000	8,000	4,000	1,000
trans-1,2-Dichloroethene	100	90**	50,000	100
Trichloroethene	5	30	5,000	5
Vinyl Chloride	2	2	50,000	2

Notes:
* Compounds Detected November 2006 LTM Round and MCP Method 1 Standards and EPA MCLs
Shaded cells indicate which standard establishes the PRG for the compound
MCL - Maximum Concentration Limit and shown in ug/L (parts per billion or ppb)
MCP - Massachusetts Contingency Plan (310 CMR 40)
MCP Method 1 Standards (GW-1, GW-2 & GW-3) obtained from 310 CMR 40.0974(2) and shown in ug/L (parts per billion or ppb)
** GW-2 Standard applies if contamination is found within 30 feet of an existing occupied building or structure, and the average annual depth to groundwater in that area is 15 feet or less
annual depth to groundwater in that area is 15 feet or less
NA - Standard not available

2.14 Statutory Determinations

The selected remedy was developed by combining components of different source control and removal/destruction and management of migration technologies to obtain a comprehensive approach for site remediation. In summary, the response action will provide protection of human health and the environment by effectively containing/ removing/destroying the source of the groundwater contamination, by containing the continued migration of groundwater contaminants and by reducing the overall extent of the groundwater plume via a reduction in the contaminant mass. The site risks associated with exposure to groundwater and soil contamination will be reduced through the implementation of land use controls/institutional controls.

The remedial action selected for implementation at OU-1 is consistent with CERCLA and, to the extent practicable, the NCP. The selected remedy is protective of human health and the environment, will comply with ARARs and is cost effective. In addition, the selected remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable, and satisfies the statutory preference for treatment as a principal element.

2.14.1 The Selected Remedy is Protective of Human Health and the Environment

The remedy at this site will adequately protect human health and the environment by eliminating, reducing or controlling exposures to human and environmental receptors through contaminant removal and treatment, engineering controls and land use controls/institutional controls. More specifically, for groundwater, this remedy protects human health and the environment by hydraulically confining the plume of dissolved contaminants and preventing contaminant migration to potential exposure points. Continued operation of the existing remediation system will draw contamination back from conservation lands owned by the Town of Bedford to the original contaminant release areas and reduce the concentration of potential groundwater discharges to surface water. In addition, the implementation of LUCs/ICs will serve to control access to and exposure to the contaminated media whilst the remedy operates to meet the cleanup goals and ARARs. Monitoring groundwater and surface water within OU-1 will serve as an early warning system. Implementation of the selected remedy will not pose any unacceptable short-term risks or cause any cross-media impacts.

2.14.2 The Selected Remedy Complies With ARARs

The selected remedy will comply with all federal and any more stringent state ARARs that pertain to the site. ARARs for OU-1 include both federal and state requirements and are listed below and presented in more detail in Appendix D. A discussion of why these requirements are applicable or relevant and appropriate may be found in the 2007 Revised FFS Report in Section 2.3. **Federal requirements include:**

1. Safe Drinking Water Act MCLs (40 CFR 141.11-141.16) (USEPA 1999)
2. Safe Drinking Water Act MCLGs (40 CFR 141.50-141.51)
3. Safe Drinking Water Act Underground Injection Control Program (UIC) (40 CFR 141-148)
4. Fish and Wildlife Coordination Act (16 USC 661 et seq.)

5. Protection of Wetlands - Executive Order 11990 (40 CFR 6, Appendix A)
6. Protection of Floodplains, Executive Order 11988 (40 CFR 6, Appendix A)
7. Clean Water Act National Pollutant Discharge Elimination System (NPDES) Regulations (40 CFR 122-125 and 131)
8. RCRA 40 CFR Part 264, Subpart F - Releases from Solid Waste Management Units (40 CFR 264.90 - 264.101 and 265.90 - 265.94)
9. RCRA Identification and Listing of Hazardous Wastes (40 CFR 261.24)
10. RCRA Standards Applicable to Generators of Hazardous Waste (40 CFR Part 262)
11. RCRA Air Emission Standards for Process Vents; Equipment Leaks; and Tanks, Surface Impoundments and Containers, 40 CFR Part 264, Subpart AA; Subpart BB; & CC
12. USEPA Policy on Control of Air Emissions from Superfund Air Strippers at Superfund Groundwater Sites, Office of Solid Waste and Emergency Response (OSWER) Directive 9355.0-28
13. USEPA New England Region Memorandum, 12 July 1989 from Louis Gitto to Merril S. Hohman
14. USEPA Risk References Doses, Carcinogen Assessment Group Cancer Slope Factors, Guidelines for Carcinogen Risk Assessment, and Supplemental Guidance for Assessing Susceptibility from Early Life Exposure to Carcinogens

State requirements include:

1. Massachusetts Drinking Water Standards (310 CMR 22)
2. Massachusetts Contingency Plan Method 1 GW-1 Standards (310 CMR 40.0974)
3. Massachusetts Groundwater Quality Standards (314 CMR 6.00)
4. Massachusetts Wetlands Regulations (310 CMR 10.51-10.60, MGL c. 131, Section 40: Wetlands Protection Act)
5. Massachusetts Clean Waters Act - Surface Water Discharge Permit Program (314 CMR 3.00; MGL c. 21 Sections 26-53)
6. Massachusetts Groundwater Discharge Permit Program (314 CMR 5.00; MGL c.21 Sections 26-53)
7. Massachusetts Underground Injection Control (UIC) Program (310 CMR 23.01-23.11)
8. Massachusetts Hazardous Waste Management Rules (HWMR), Requirements for Generators (310 CMR 30.300-30.371)
9. Massachusetts HWMR, Groundwater Protection (310 CMR 30.660-30.679)
10. Massachusetts HWMR, Use and Management of Containers(310 CMR 30.689); Storage and Treatment in Tanks (310 CMR 30.699)
11. Massachusetts Standards for Analytical Data for Remedial Response Action, Bureau of Waste Site Cleanup Policy 300-89.
12. Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas (May 2003)
13. Massachusetts Well Decommissioning Requirements (313 CMR 3.03)
14. Massachusetts Air Pollution Control Regulations (310 CMR 7.09)
15. Massachusetts Rules for Remedial Air Emissions (310 CMR 40.0049)
16. MADEP Off-gas Treatment of Point Source Remedial Air Emissions (Policy No. WSC-94-150)

17. *Massachusetts Threshold Exposure Limits (TELs) and Allowable Ambient Limits for Ambient Air*

2.14.3 The Selected Remedy is Cost-Effective

In the USAF's judgment, the selected remedy is cost-effective because the remedy's costs are proportional to its overall effectiveness (see 40 CFR 300.430(f)(1)(ii)(D)). This determination was made by evaluating the overall effectiveness of the only alternative that satisfied the threshold criteria (i.e., that are protective of human health and the environment and comply with all federal and any more stringent ARARs). Overall effectiveness was evaluated by assessing three of the five balancing criteria -- long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness, in combination. The overall effectiveness of the remedy then was compared to the remedy's costs to determine cost-effectiveness. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs and hence represents a reasonable value for the money to be spent. Costs for the selected remedy are presented in Appendix C.

2.14.4 The Selected Remedy Utilizes Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The selected remedy utilizes permanent solutions including groundwater treatment, vacuum enhanced recovery, and alternate treatment technologies including groundwater treatment with permanganate and molasses to the maximum extent practicable. Using contaminate fate and transport models, estimates were calculated for how long it would take to eliminate the risks to human health and the environment posed by the site's contaminants under each alternative. The selected remedy, Alternative G-3, was the only one estimated to eliminate the risks within an acceptable time frame (30-50 years).

2.14.5 The Selected Remedy Satisfies the Preference for Treatment as a Principal Element

The statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principle element, is fully addressed in this remedy

2.14.6 Five-Year Reviews of the Selected Remedy are Required

Because this remedy will result in hazardous substances initially remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted by the Air Force each five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. The Periodic Review Assessment Report will be in accordance with EPA guidance and the report will be submitted to EPA and the State for comment and/or concurrence. Five-year reviews will be conducted as long as any hazardous substances, pollutants or contaminants remain at the site (above levels that allow for unlimited use and unrestricted exposure) to assure that the remedial action continues to protect human health and the environment.

2.15 Documentation of Significant Changes

Hanscom AFB presented a Proposed Plan for NPL Operable Unit 1, dated May 2007, discussing the selected remedy. The preferred alternative was continued operation of the dynamic groundwater remediation system to provide for source control and removal /destruction and management of migration through containment of the groundwater plume and reduction in contaminant mass. Additional management of contaminants includes monitoring and land use controls/institutional controls. Hanscom AFB reviewed all written and verbal comments submitted during the public comment period. It was determined that no significant changes to the remedy, as originally identified in the proposed plan, were necessary.

2.16 State Role

The MADEP has reviewed the various alternatives and has indicated its support for the selected remedy. The State has also reviewed the 2007 Revised FFS to determine if the selected remedy is in compliance with applicable or relevant and appropriate State environmental and facility siting laws and regulations. The MADEP concurs with the selected remedy for OU-1. A copy of the declaration of concurrence is attached as Appendix E.

3.0 Responsiveness Summary

3.1 Overview

Following completion of the 2007 Revised Focused Feasibility Study (FFS) for Operable Unit 1 (OU-1), Hanscom Air Force Base (AFB) identified a preferred remedial action for the site which was provided to the public for comment in the Proposed Plan (PP). The preferred alternative involves continued operation of the existing dynamic groundwater remediation; continuing the monitoring program; and implementing/maintaining, monitoring and enforcing of Land Use Controls (LUCs)/Institutional Controls (ICs). To the extent required by law, the USAF will review the site at least once every five years after the initiation of remedial action at the site if any hazardous substances, pollutants or contaminants remain at the site (above levels that allow for unlimited use and unrestricted exposure) to assure that the remedial action continues to protect human health and the environment.

The 2007 Proposed Plan converts the interim remedy selected by the Interim Record of Decision (IROD) in 2000 to a "final" remedy. The 2007 PP, in conjunction with the 2000 IROD, also updates the Remedial Action Plans (RAPs) finalized in 1987 for Installation Restoration Program (IRP) Sites 1, 2 and 3/5 which included Removal Actions at Sites 1, 2 and 3 and the construction of a groundwater collection, treatment and recharge system to address the groundwater contamination in the area now designated as Operable Unit 1. This system has operated continuously since its start-up in 1991.

Judging from the limited number of comments received during the public comment period, it appears the community supports the proposed remedial alternative for OU-1.

3.2 Background on Community Involvement

The Massachusetts Department of Environmental Protection (MADEP) is aware of the nature of the proposed remedial alternative for OU-1, and has been involved in reviewing the original RAPs, subsequent supplemental investigations and the focused feasibility studies reports and planning efforts. The community has been kept advised of the OU-1 conditions through regular meetings of a Technical Review Committee (TRC) established in 1993 which was subsequently converted/expanded to a Restoration Advisory Board (RAB) which includes residents of the surrounding communities. The RAB was established in 1994 and has been meeting regularly with updates and discussions related to OU-1 investigations and remedial action planning. The RAB meetings have been open to the public, and notices have been published in local newspapers identifying the date, time, and location of the meetings. Also see Section 2.3, Community Participation, for a brief chronology of public outreach efforts associated with OU-1/IRP Sites 1, 2 and 3.

The public comment period for the 2007 OU-1 Proposed Plan was from June 8, 2007 to July 9, 2007. In addition, a public meeting and a public hearing were conducted on June 20, 2007 in Bedford, MA to discuss the 2007 OU-1 Proposed Plan and to accept oral comments.

3.3 Summary of Public Comments Received During Public Comment Period and Agency Responses

No written comments were received during the comment period, including the public hearing. During the public hearing on June 20, 2007 oral comments were accepted from the public. A verbatim transcript of the hearing as recorded by a court reporter is included as **Appendix B** to this ROD. Comments received during the hearing and Hanscom AFB's responses to the comments follows.

Comment from Bedford resident: On the information I have heard in the previous session, I think we should approve the plan. We should go forward as presented to the RAB meeting and to continue the progress of water treatment and Operating Unit 1 and monitoring.

> **Response:** Hanscom AFB appreciates this support of the proposed remedial alternative for OU-1.

Comment from MA DEP representative: We'll provide comments by the end of the public comment period.

> **Response:** Hanscom AFB appreciates the continued support of the Massachusetts Department of Environmental Protection for all of the on-going remedial actions.

Comment from Hanscom AFB employee: Is there any risk that funding will be decreased or at least cut back to where you could not implement G-3?

> **Verbal Response at the hearing from Hanscom AFB' Environmental Director:** Based upon the 20-year funding of this program where every -- every one of those 20 years we've been fully funded. So based on that record it's -- we're confident that the funding levels that we need should be available, especially when you look at the big picture, but, of course, it's always subject to the approval of you folks. But we have been fully funded for the last -- since day 1.

3.4 Remaining Concerns

Hanscom AFB is not aware of any concerns that were unable to be addressed during the public comment period.

4.0 References - OU-1 and Hanscom AFB Specific Documents

AFCEE. *Remedial Process Optimization (RPO) Handbook;* June 2001

Arcadis G&M, Inc. *Demonstration of Vacuum Enhanced Recovery Technology at Site 1, Hanscom AFB, MA;* June 2000

Arcadis G&M, Inc. *Final Report: In-situ Substrate Addition to Create Reactive Zones for Treatment of Chlorinated Aliphatic Hydrocarbons: Hanscom AFB;* April 2003

ASTDR. Final *Public Health Assessment for Hanscom Field/Hanscom AFB;* April 2004

CDW Consultants. *Focused Groundwater Flow and Transport Model, Operable Unit 1 Hanscom Air Force Base, Bedford MA;* May 2007

CH2M Hill, Inc. *Draft Solute Transport Model Setup and Calibration Report, Operable Unit 1, Hanscom AFB, MA;* December 1997

CH2M Hill, Inc. *Draft Groundwater Flow Model Report, Operable Unit 1, Hanscom AFB, MA;* July 1997

CH2M Hill, Inc. *OU-1 Field Report, Hanscom AFB, MA;* January 1998

CH2M Hill, Inc. *Technical Memorandum: Soil to Groundwater Pathway, OU-1, Hanscom AFB, MA;* December 1998

CH2M Hill, Inc. *Final Ecological Risk Assessment, Operable Unit 1, Hanscom AFB, MA;* January 1999

CH2M Hill, Inc. *Final Focused Feasibility Study, Operable Unit 1, Hanscom AFB, MA;* April 1999

CH2M Hill, Inc. *Final Interim Proposed Plan for Hanscom AFB Operable Unit 1, Bedford/Concord, MA;* June 2000

CH2M Hill, Inc. *Final Interim Record of Decision, Operable Unit 1, Hanscom AFB, MA;* November 2000

CH2M Hill, Inc. Technical Memorandum, December 13, 2000

Haley & Aldrich, Inc. *IRP Phase IV-A, Hanscom AFB Area 1, Introduction to Remedial Action Plans, Hanscom AFB, MA;* May 1988

Haley & Aldrich, Inc. *IRP Phase IV-A, Hanscom AFB Area 1, Remedial Action Plan for Sites 1, 2, and 3/5, Hanscom AFB, MA;* May 1988

Haley & Aldrich, Inc. IRP *Phase IV-A, Hanscom AFB Area 1, Environmental Assessment, Hanscom AFB, MA;* May 1988

Haley & Aldrich, Inc. *Architect-Engineer Field Investigation Report, Sampling Round 11, May 1998, Long Term Sampling Program, Hanscom AFB, Bedford, MA;* September 1998

Hanscom AFB. *Decision Document - Area 1 (Sites 1-5);* April 1988

Hanscom AFB. Monthly *Remedial Action Reports for OU-1;* April 1991 to present

Hanscom AFB. Restoration Advisory Board (RAB) Meeting Minutes; November 1994 to present

Hanscom AFB. Community Relations Plan for CERCLA (Superfund) Remedial Response Actions and Removal Actions; April 1999

Hanscom AFB. *Final Second Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site;* August 2002

Hanscom AFB. *Final Revised Focused Feasibility Study, NPL Operable Unit 1, Hanscom Air Force Base, MA;* May 2007

Hanscom AFB. *Final Proposed Plan for Hanscom Air Force Base National Priorities List Operable Unit 1, Bedford/Concord, MA;* May 2007

Hanscom AFB. Draft *Third Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site;* August 2007

IT Corporation. *Analytical Data Package Reports for Long-Term Monitoring of OU-1:*

1999 Samples; April 2000

April 2000 Samples; August 2000

June 2000 Samples; October 2000

September 2000 Samples; January 2001

November 2000 Samples; March 2001

January 2001 Samples; April 2001

September/November 2001 Samples; March 2002

April 2002/Site 3Samples; August 2002

September 2002 Samples; January 2003

LEC Environmental Consultants, Inc. *Final Comprehensive Ecological Analysis, Hanscom AFB, MA;* August 1997

MaraTech Engineering Services, Inc. *Basewide Quality Assurance Project Plan (QAPP) for LTM at NPL OU-1, NPL OU-2/IRP Site 6, NPL OU-3/IRP Site 21, and MCP Sites (IPR Sites 13 & 22 and the FAFSUST Site);* July 2004

Massport. Draft *2005 L.G. Hanscom Field Environmental Status & Planning Report, Bedford, MA;* November 2006

Parsons Brinckerhoff Quade & Douglas, Inc. *General Plan Update, Hanscom AFB, MA;* November 2003

Shaw Environmental, Inc. *Permanganate Addition Pilot Study Report for Remediation of OU-1 Site 1, Hanscom AFB, MA;* September 2003

Shaw Environmental, Inc. *Long-Term Monitoring Reports for OU-1:*

November & December 2002 Samples; March 2007

November 2003 Samples; April 2004

November 2004 Samples; March 2005

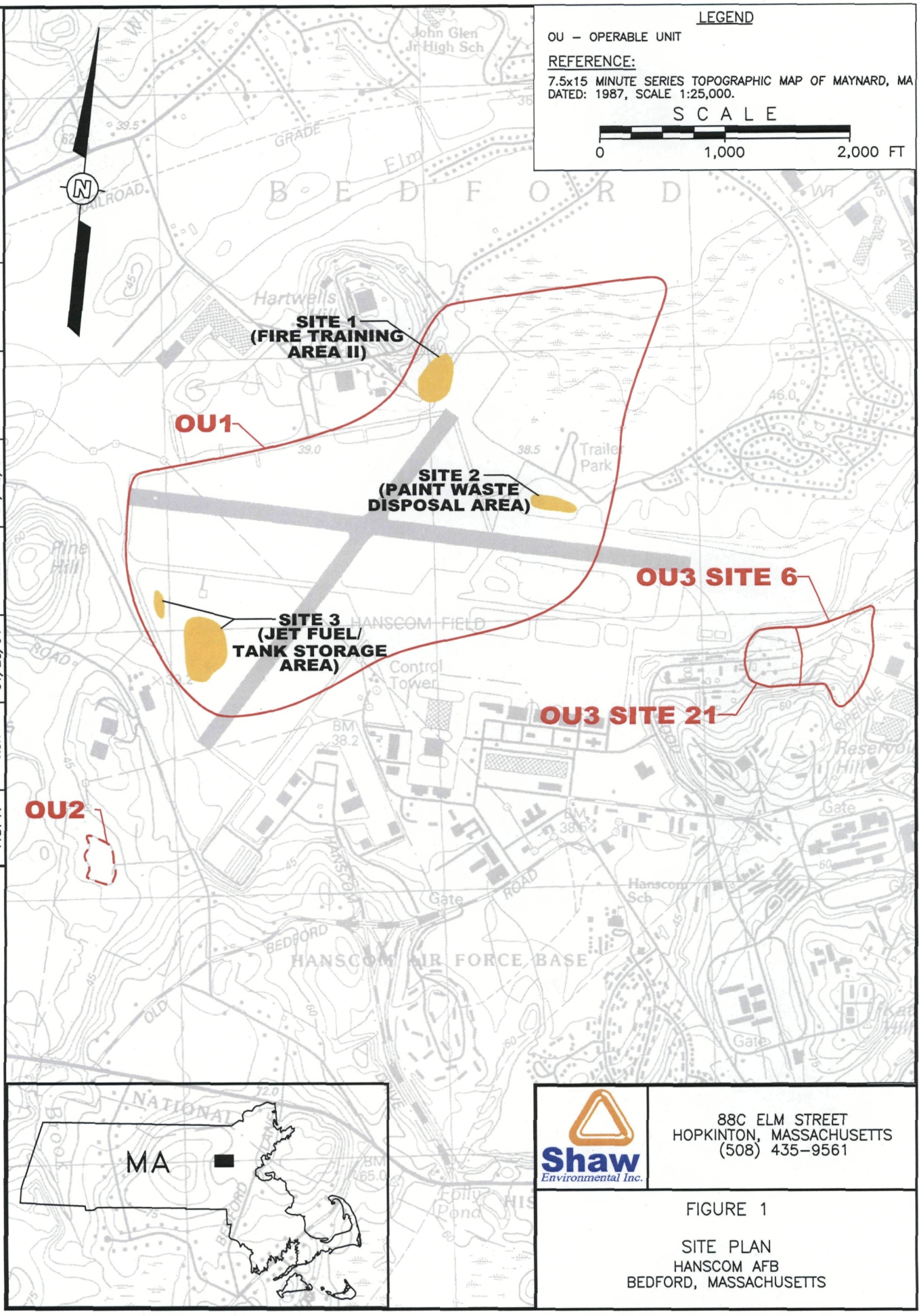
November 2005 Samples; March 2006

November 2006 Samples; May 2007

USEPA. *Innovations in Site Characterization: Case Study, Hanscom AFB OU-1 (Sites 1, 2 & 3);* September 1998

USGS. *Sampling of Volatile Organic Compounds in Groundwater by Diffusion Samples and a Low-Flow Method, and Collection of Borehole-Flowmeter Data, Hanscom AFB, MA; 2000*

FIGURES



OFFICE	DRAWN	CHECKED BY	APPROVED BY	DRAWING NUMBER
HOPK	KCK 01/28/04	MQ 01/28/04		SITE9-2.dwg

Shaw Environmental Inc.

88C ELM STREET
HOPKINTON, MASSACHUSETTS
(508) 435-9561

FIGURE 1

SITE PLAN
HANSCOM AFB
BEDFORD, MASSACHUSETTS

File: N:\MIS[illegible]m AFB\2004\OU1\SITE 9-3jb.dwg Layout: O.U. LOC FIG 1-1 User: chris.desia[illegible]4, 2007 - 4:30pm
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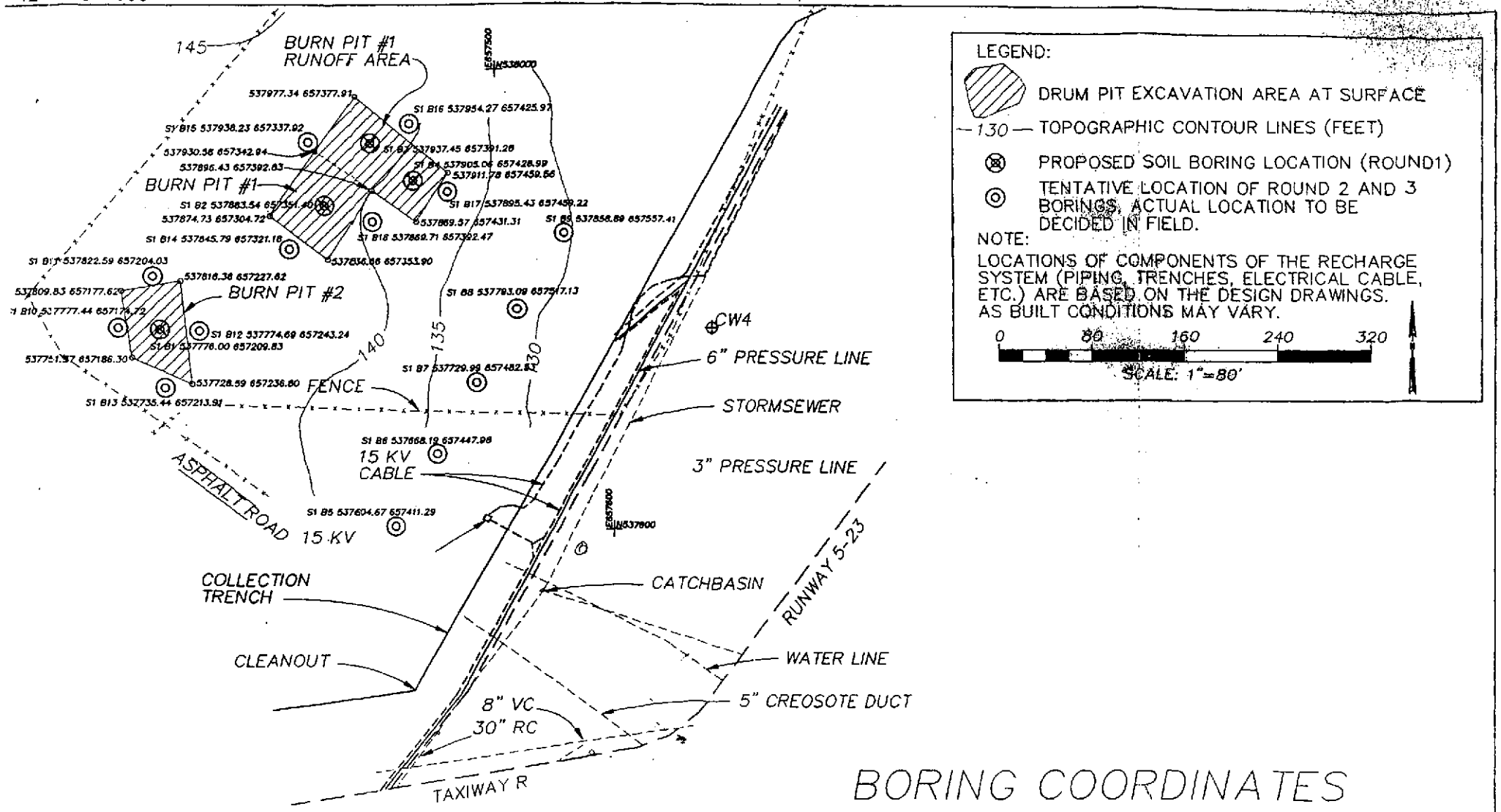


BORING COORDINATES ARE DISPLAYED FOR INTERNAL USE ONLY

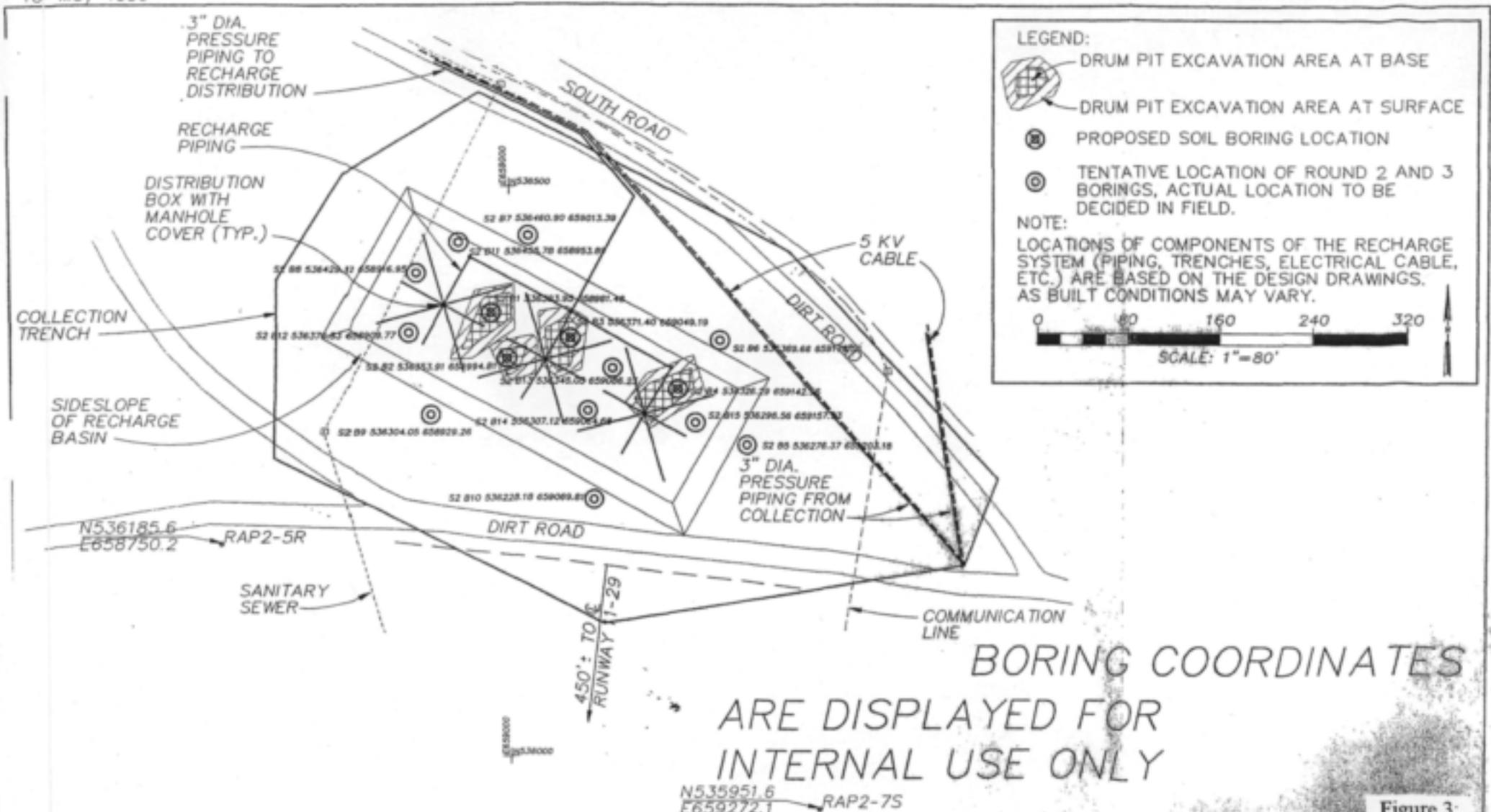
SOURCE:
DRUM PIT LOCATIONS TAKEN FROM HALEY AND ALDRICH DRAWING ENTITLED:
INSTALLATION RESTORATION PROGRAM HANSCOM AIR FORCE BASE, MASSACHUSETTS
SITE 1 - EXISTING CONTOUR & DRUM PIT LOCATIONS"
RECHARGE SYSTEM LOCATIONS TAKEN FROM HALEY AND ALDRICH DRAWING ENTITLED:
INSTALLATION AND RESTORATION PROGRAM HANSCOM AIR FORCE BASE, MASSACHUSETTS
STAGE II GROUND WATER TREATMENT PRESSURE LINE ALIGNMENT PLAN/SITE 1 COLLECTION TRENCH

Figure 2:

SOIL BORING LOCATIONS
SITE 1
HANSCOM AFB

ITE3TP.DWG

15-May-1996



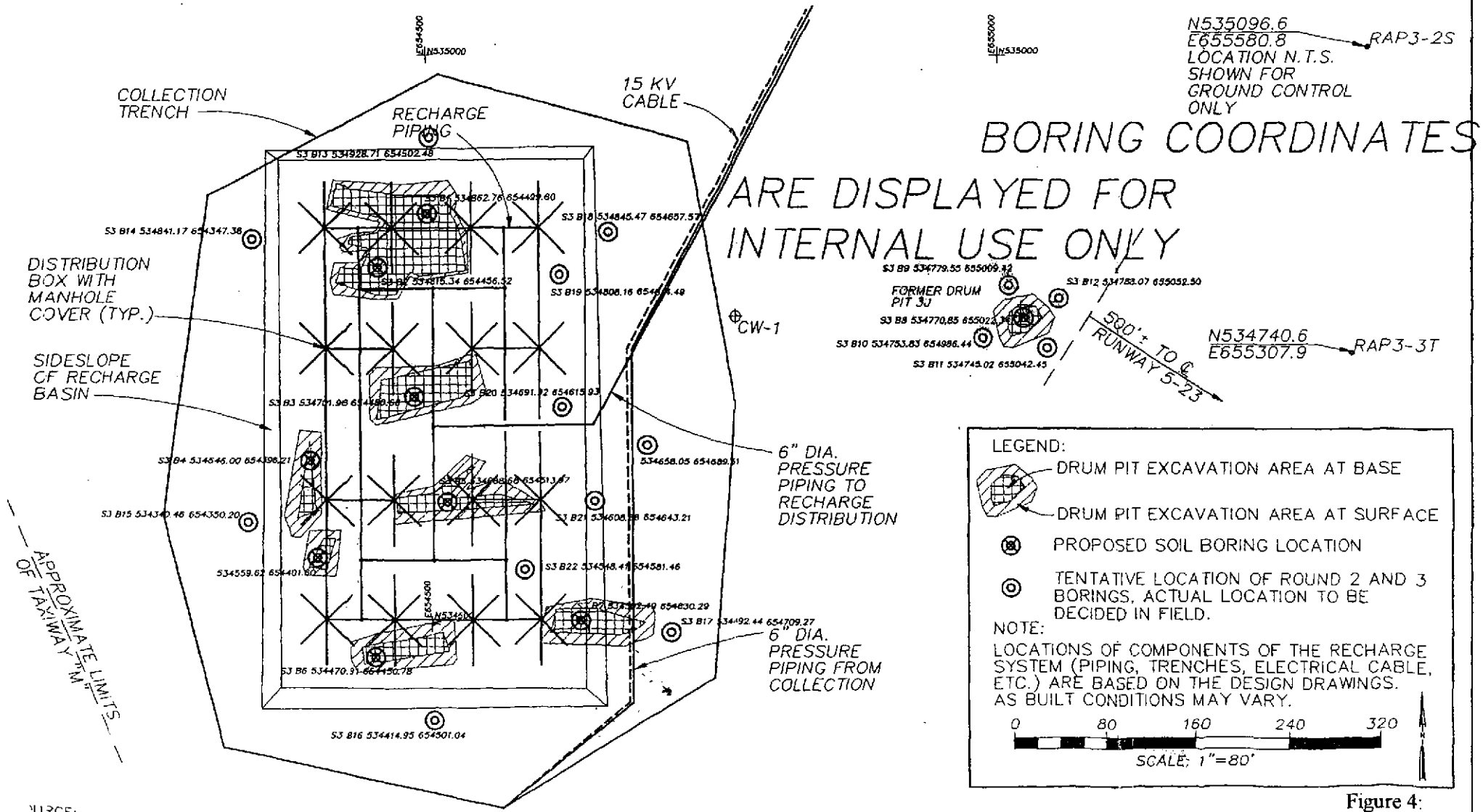
BORING COORDINATES ARE DISPLAYED FOR INTERNAL USE ONLY

Figure 3:

SOIL BORING LOCATIONS

SOURCE:
DRUM PIT LOCATIONS TAKEN FROM HALEY AND ALDRICH DRAWING ENTITLED: "INSTALLATION RESTORATION PROGRAM HANSCOM AIR FORCE BASE, MASSACHUSETTS SITE 3 - EXISTING CONTOUR & DRUM PIT LOCATIONS"
RECHARGE SYSTEM LOCATIONS TAKEN FROM HALEY AND ALDRICH DRAWING ENTITLED: "INSTALLATION AND RESTORATION PROGRAM HANSCOM AIR FORCE BASE, MASSACHUSETTS STAGE II GROUND WATER TREATMENT SITE 2 COLLECTION TRENCH AND RECHARGE SYSTEM"

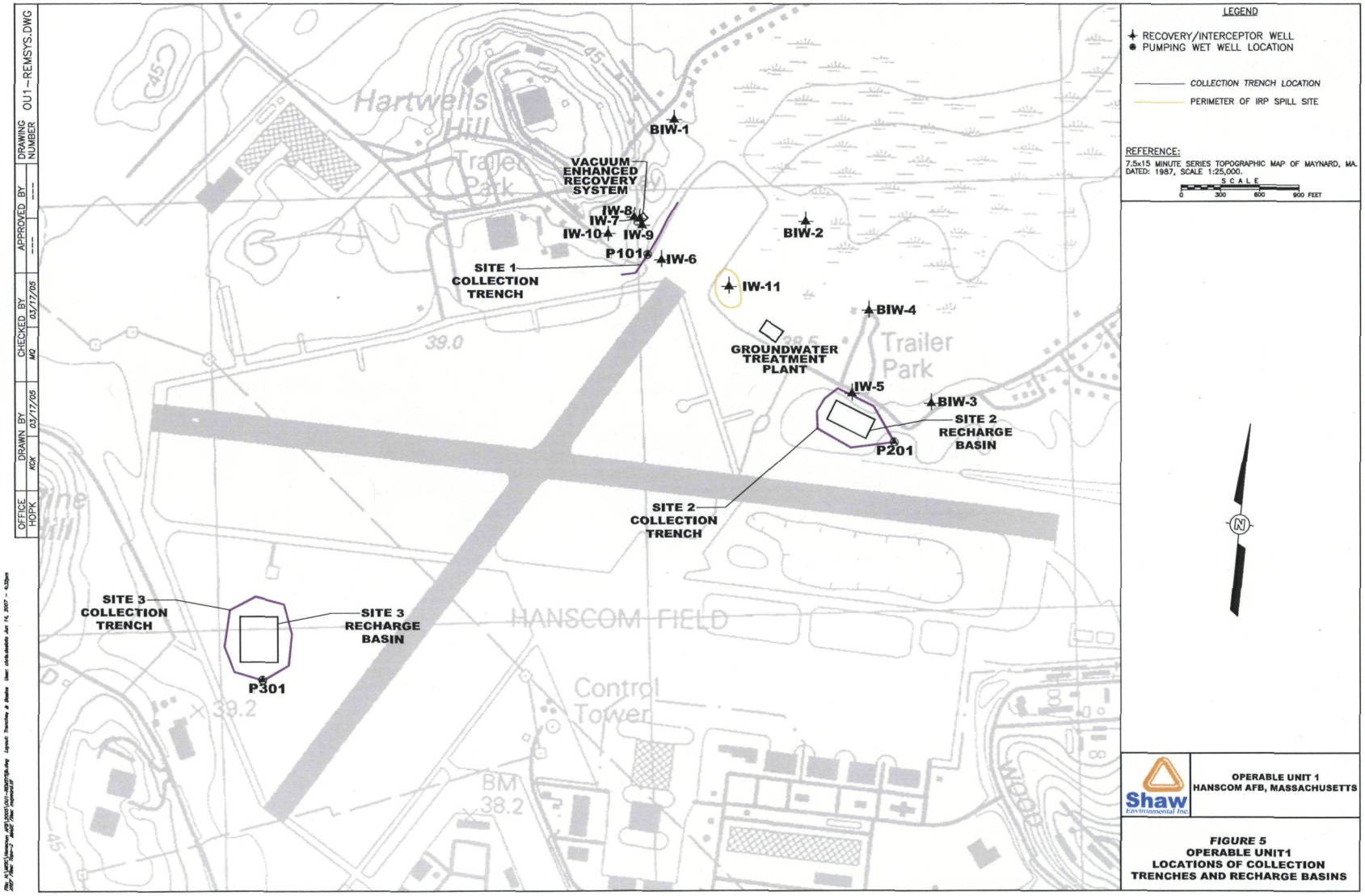
SITE3TP.DWG



SOURCE:
DRUM PIT LOCATIONS TAKEN FROM HALEY AND ALDRICH DRAWING ENTITLED:
INSTALLATION RESTORATION PROGRAM, HANSCOM AIR FORCE BASE, MASSACHUSETTS
SITE 3 - EXISTING CONTOUR & DRUM PIT LOCATIONS
RECHARGE SYSTEM LOCATIONS TAKEN FROM HALEY AND ALDRICH DRAWING ENTITLED:
"INSTALLATION AND RESTORATION PROGRAM, HANSCOM AIR FORCE BASE, MASSACHUSETTS
STAGE II GROUND WATER TREATMENT SITE 3 COLLECTION TRENCH AND RECHARGE SYSTEM

SITE3TP.DWG

Figure 4:
SOIL BORING LOCATIONS
SITE 3
HANSCOM AFB


LEGEND
RECOVERY/INTERCEPTOR WELL
PUMPING WET WELL LOCATION
COLLECTION TRENCH LOCATION
PERIMETER OF IRP SPILL SITE
REFERENCE:
7.5x15 MINUTE SERIES TOPOGRAPHIC MAP OF MAYNARD, MA.
DATED: 1987, SCALE 1:25,000.
SCALE
0 300 600 900 FEET
OFFICE HOPK
DRAWN BY KGK 03/17/05
CHECKED BY MO 03/17/05
APPROVED BY ---- ----
DRAWING NUMBER OU1-REMSYS.DWG
Hartwells Hill
Trailer Park
VACUUM ENHANCED RECOVERY SYSTEM
BIW-1
IW-8
IW-7
IW-9
IW-10
P101
IW-6
SITE 1 COLLECTION TRENCH
BIW-2
IW-11
BIW-4
GROUNDWATER TREATMENT PLANT
Trailer Park
IW-5
BIW-3
SITE 2 RECHARGE BASIN
P201
SITE 2 COLLECTION TRENCH
SITE 3 COLLECTION TRENCH
SITE 3 RECHARGE BASIN
P301
HANSCOM FIELD
Control Tower
BM 38.2
39.0
45
Shaw Environmental Inc
OPERABLE UNIT 1
HANSCOM AFB, MASSACHUSETTS
FIGURE 5
OPERABLE UNIT1
LOCATIONS OF COLLECTION TRENCHES AND RECHARGE BASINS

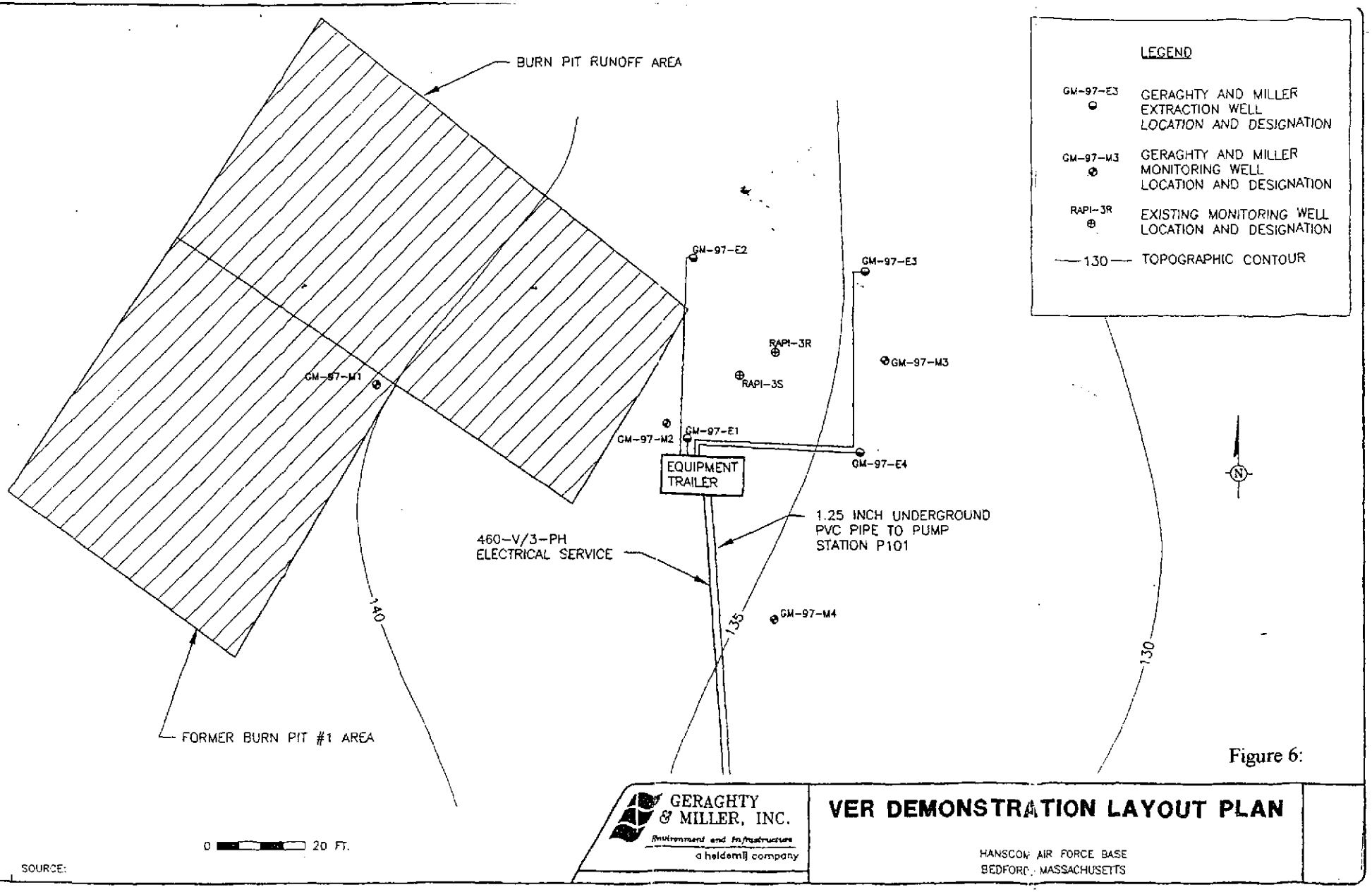
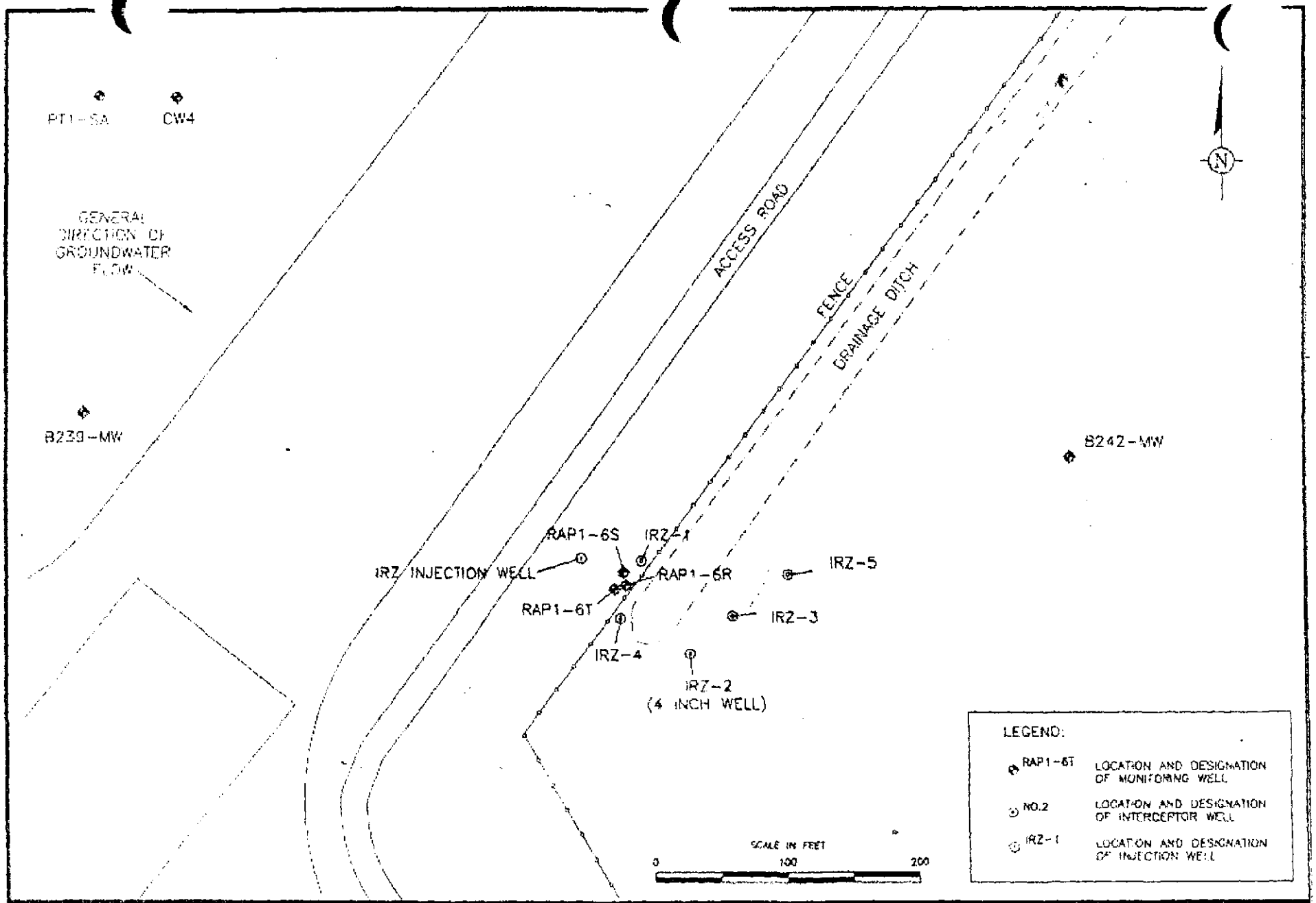

BURN PIT RUNOFF AREA
GM-97-E2
GM-97-E3
RAPI-3R
GM-97-M3
RAPI-3S
GM-97-M1
GM-97-M2
GM-97-E1
GM-97-E4
EQUIPMENT TRAILER
1.25 INCH UNDERGROUND PVC PIPE TO PUMP STATION P101
460-V/3-PH ELECTRICAL SERVICE
GM-97-M4
140
135
130
FORMER BURN PIT #1 AREA
0
20 FT.
SOURCE:
LEGEND
GM-97-E3 GERAGHTY AND MILLER EXTRACTION WELL LOCATION AND DESIGNATION
GM-97-M3 GERAGHTY AND MILLER MONITORING WELL LOCATION AND DESIGNATION
RAPI-3R EXISTING MONITORING WELL LOCATION AND DESIGNATION
130 TOPOGRAPHIC CONTOUR
GERAGHTY & MILLER, INC.
Environment and Infrastructure
a heidemij company
VER DEMONSTRATION LAYOUT PLAN
HANSCOM AIR FORCE BASE
BEDFORD, MASSACHUSETTS
ORNBACH | DRAFTED | CHECKED: D. KIRKPATRICK | APPROVED: D. KIRKPATRICK | DRAWING: -4 | PROJECT NO.: MA0551.003 | HARD FILE: -

Figure 6:



ARCADIS G&M
4915 Prospectus Drive
Suite F, DURHAM, NC 27713
Tel: 919/544-4535 Fax: 919/544-5690

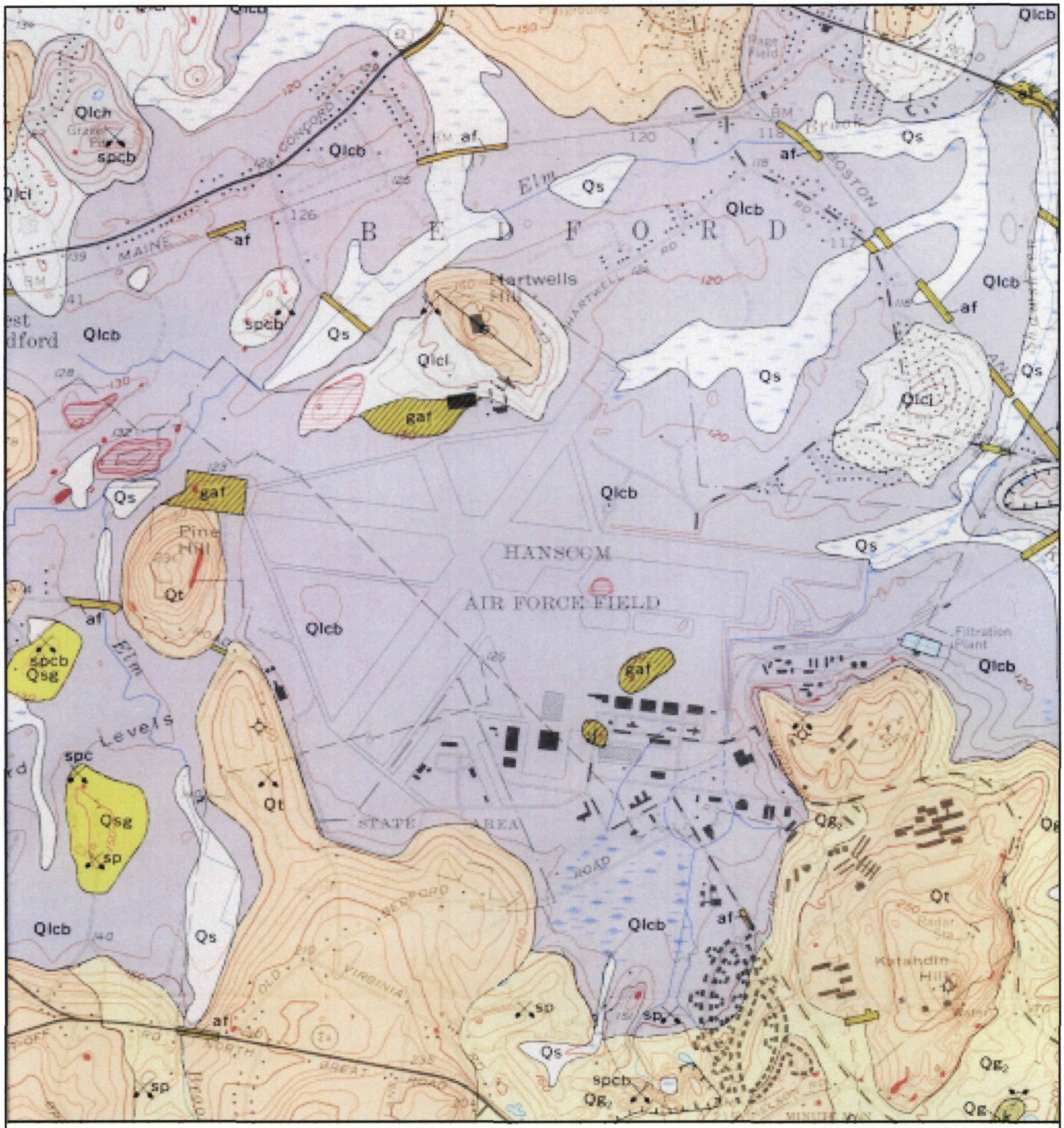
SITE LAYOUT

HANSCOM AFB
BEDFORD, MASSACHUSETTS

PROJECT MANAGER C. LUTES	DRAWING NUMBER PILOT-TEST-AREA
CHECKED BY V. D'AMATO	PROJECT NUMBER RN000301.0012.00001
DRAWN BY A. NORTON	
DATE DRAWN 20JUN01	

Figure 7:

138808.FS.ZZ<Surfic>cac.wdc.04/00



0 1 Mile

N

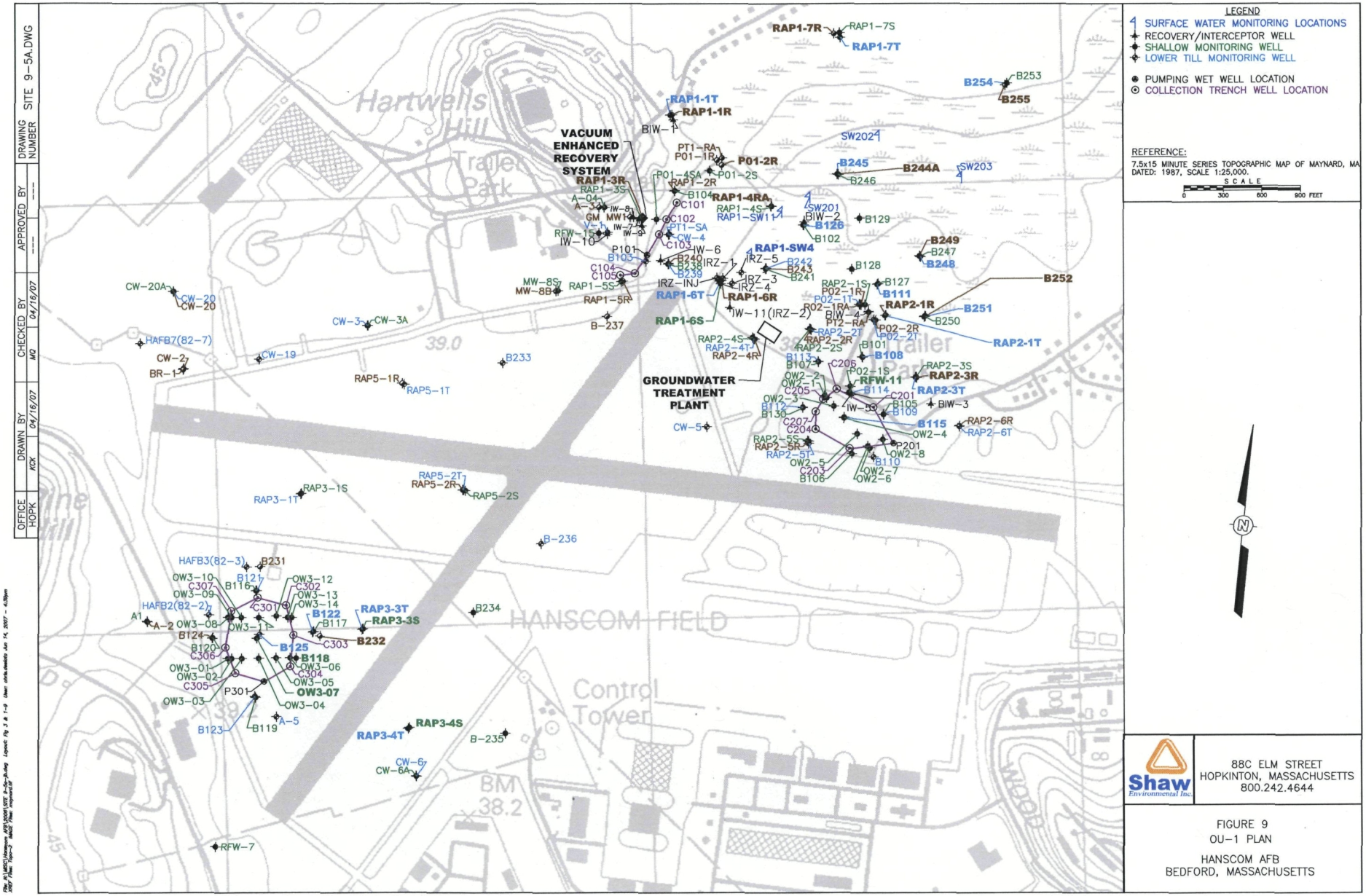
LEGEND

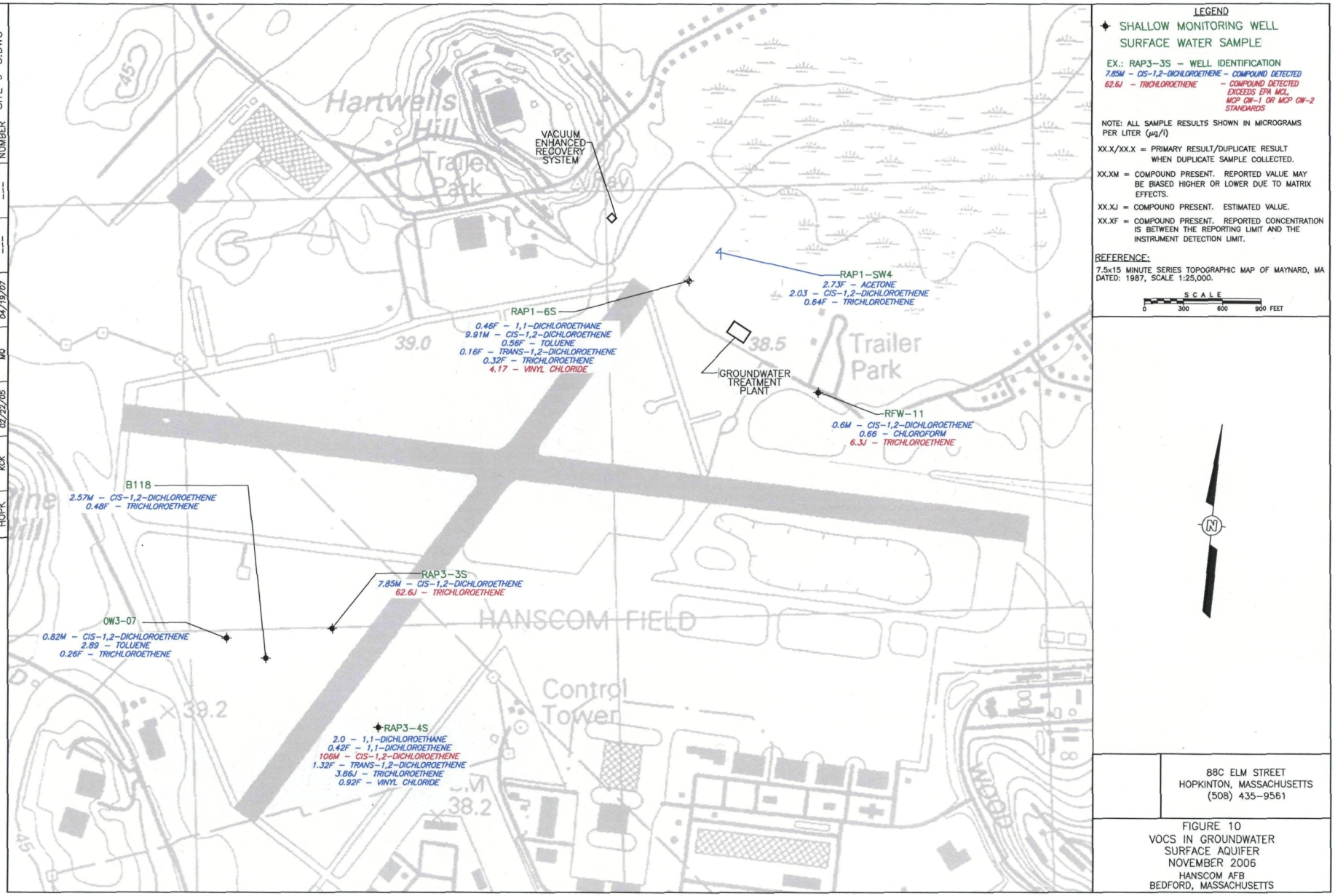
gaf	graded and filled	Qlcl	low stage lake deposits
Qg_2	sand, gravel, and silt	Qs	swamp deposits
Qlcb	lake bottom deposits	Qsg	sand and gravel
Qlch	high stage lake deposits	Qt	till

Source: U.S. Geological Survey Map GQ-331. Surficial Geology of the Concord Quadrangle. Carl Koteff, 1964.

Figure 8
SURFICAL GEOLOGY OF THE MODELED AREA
Hanscom Air Force Base
Operable Unit 1

CH2MHILL


LEGEND
SURFACE WATER MONITORING LOCATIONS
RECOVERY/INTERCEPTOR WELL
SHALLOW MONITORING WELL
LOWER TILL MONITORING WELL
PUMPING WET WELL LOCATION
COLLECTION TRENCH WELL LOCATION
REFERENCE:
7.5x15 MINUTE SERIES TOPOGRAPHIC MAP OF MAYNARD, MA
DATED: 1987, SCALE 1:25,000.
SCALE
0 300 600 900 FEET
VACUUM ENHANCED RECOVERY SYSTEM
GROUNDWATER TREATMENT PLANT
HANSCOM FIELD
Control Tower
Hartwells Hill
Trailer Park
RAP1-7R
RAP1-7S
RAP1-7T
RAP1-1T
RAP1-1R
RAP1-3R
RAP1-2R
RAP1-4RA
RAP1-SW4
RAP1-6T
RAP1-6R
RAP1-6S
RAP1-5S
RAP1-5R
P01-2R
B254
B253
B255
B245
B244A
B246
SW202
SW203
SW201
B128
B129
B102
B249
B247
B248
B252
B251
B250
RAP2-1R
RAP2-1T
RAP2-3R
RAP2-3T
RAP2-6R
RAP2-6T
RFW-11
B115
B111
B108
RAP3-1T
RAP3-1S
RAP3-2T
RAP3-2S
RAP3-3T
RAP3-3S
RAP3-4T
RAP3-4S
RAP5-1R
RAP5-1T
RAP5-2R
RAP5-2S
B-236
B-237
B-235
B233
B234
B232
B231
B122
B125
B118
OW3-07
RFW-7
CW-20A
CW-20
CW-3
CW-3A
CW-19
CW-2
BR-1
HAFB7(82-7)
HAFB3(82-3)
HAFB2(82-2)
CW-5
CW-6
CW-6A
BM 38.2
39.0
45
88C ELM STREET
HOPKINTON, MASSACHUSETTS
800.242.4644
Shaw
Environmental Inc.
FIGURE 9
OU-1 PLAN
HANSCOM AFB
BEDFORD, MASSACHUSETTS
OFFICE HOPK
DRAWN BY KCX 04/16/07
CHECKED BY MO 04/16/07
APPROVED BY --- ---
DRAWING NUMBER SITE 9-5A.DWG



LEGEND

SHALLOW MONITORING WELL
SURFACE WATER SAMPLE

EX.: RAP3-3S - WELL IDENTIFICATION
7.85M - CIS-1,2-DICHLOROETHENE - COMPOUND DETECTED
62.6J - TRICHLOROETHENE - COMPOUND DETECTED EXCEEDS EPA MCL, MCP GW-1 OR MCP GW-2 STANDARDS

NOTE: ALL SAMPLE RESULTS SHOWN IN MICROGRAMS PER LITER (µg/l)

XX.X/XX.X = PRIMARY RESULT/DUPLICATE RESULT WHEN DUPLICATE SAMPLE COLLECTED.

XX.XM = COMPOUND PRESENT. REPORTED VALUE MAY BE BIASED HIGHER OR LOWER DUE TO MATRIX EFFECTS.

XX.XJ = COMPOUND PRESENT. ESTIMATED VALUE.

XX.XF = COMPOUND PRESENT. REPORTED CONCENTRATION IS BETWEEN THE REPORTING LIMIT AND THE INSTRUMENT DETECTION LIMIT.

REFERENCE:

7.5x15 MINUTE SERIES TOPOGRAPHIC MAP OF MAYNARD, MA DATED: 1987, SCALE 1:25,000.

SCALE
0 300 600 900 FEET

88C ELM STREET
HOPKINTON, MASSACHUSETTS
(508) 435-9561

FIGURE 10
VOCS IN GROUNDWATER
SURFACE AQUIFER
NOVEMBER 2006
HANSCOM AFB
BEDFORD, MASSACHUSETTS

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
HOPK	KCK 02/22/05	MO 04/19/07	---	SITE 9-5.DWG

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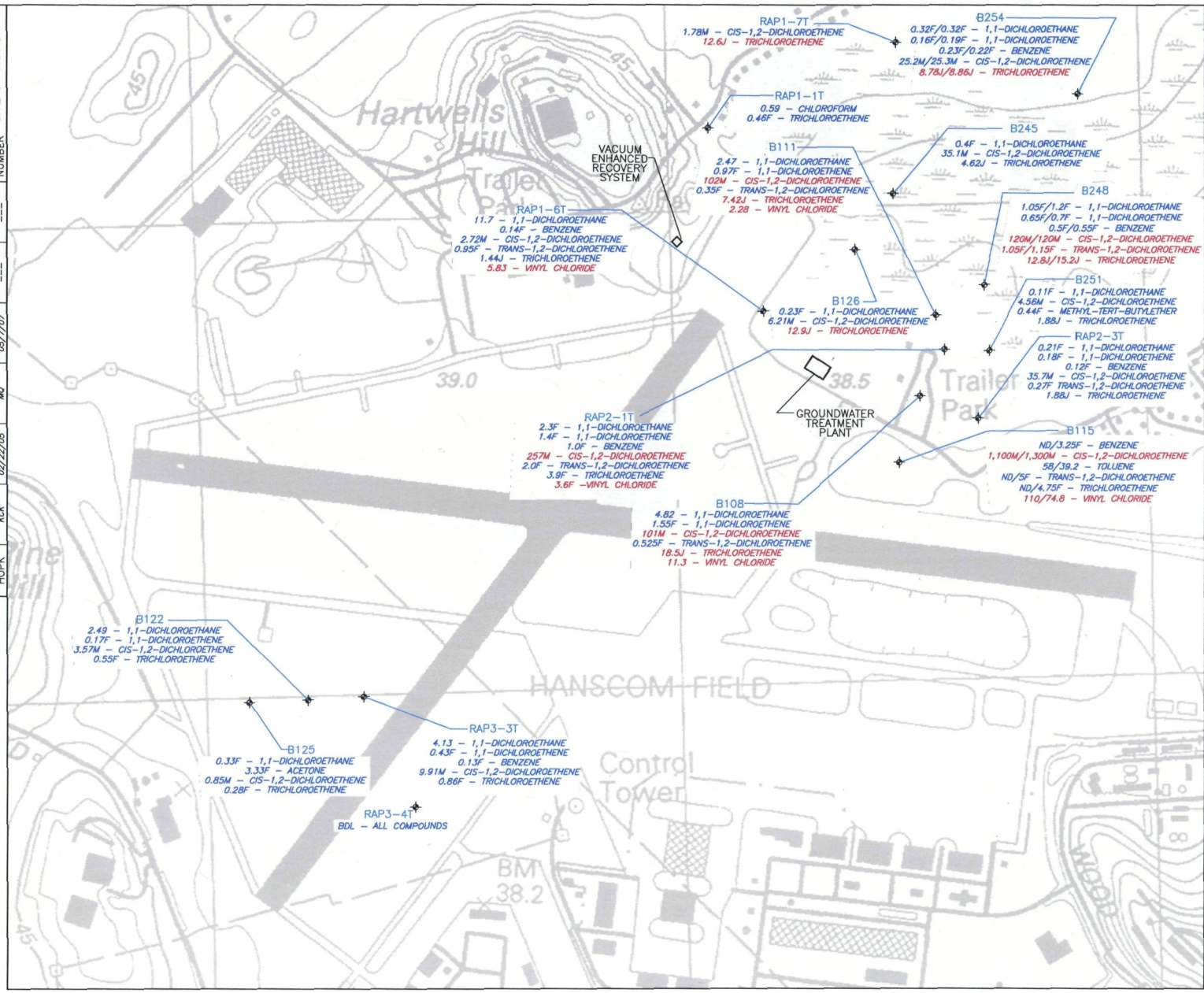

LEGEND

LOWER TILL MONITORING WELL
EX.: B126 – WELL IDENTIFICATION

0.23F – 1,1-DICHLOROETHANE – COMPOUND DETECTED
6.21M – CIS-1,2-DICHLOROETHENE – COMPOUND DETECTED
12.9J – TRICHLOROETHENE – COMPOUND DETECTED EXCEEDS EPA MCL, MCP GW-1 OR MCP GW-2 STANDARDS

NOTES: ALL SAMPLE RESULTS SHOWN IN MICROGRAMS PER LITER (ug/l).

XX.X/XX.X = PRIMARY RESULT/DUPLICATE RESULT WHEN DUPLICATE SAMPLE COLLECTED.

XX.XM = COMPOUND PRESENT. REPORTED VALUE MAY BE BIASED HIGHER OR LOWER DUE TO MATRIX EFFECTS.

XX.XJ = COMPOUND PRESENT, ESTIMATED VALUE.

XX.XF = COMPOUND PRESENT. REPORTED CONCENTRATION IS BETWEEN THE REPORTING LIMIT AND THE INSTRUMENT DETECTION LIMIT.

BDL = BELOW DETECTION LIMIT

REFERENCE:

7.5x15 MINUTE SERIES TOPOGRAPHIC MAP OF MAYNARD, MA DATED: 1987, SCALE 1:25,000.

SCALE
0 300 600 900 FEET

N

88C ELM STREET
HOPKINTON, MASSACHUSETTS
(508) 435-9561

FIGURE 11
VOCS IN GROUNDWATER
LOWER/TILL AQUIFER
NOVEMBER 2006
HANSCOM AFB
BEDFORD, MASSACHUSETTS

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HOPK	KCK 02/22/05	MQ 05/7/07	---	SITE 9-5.DWG

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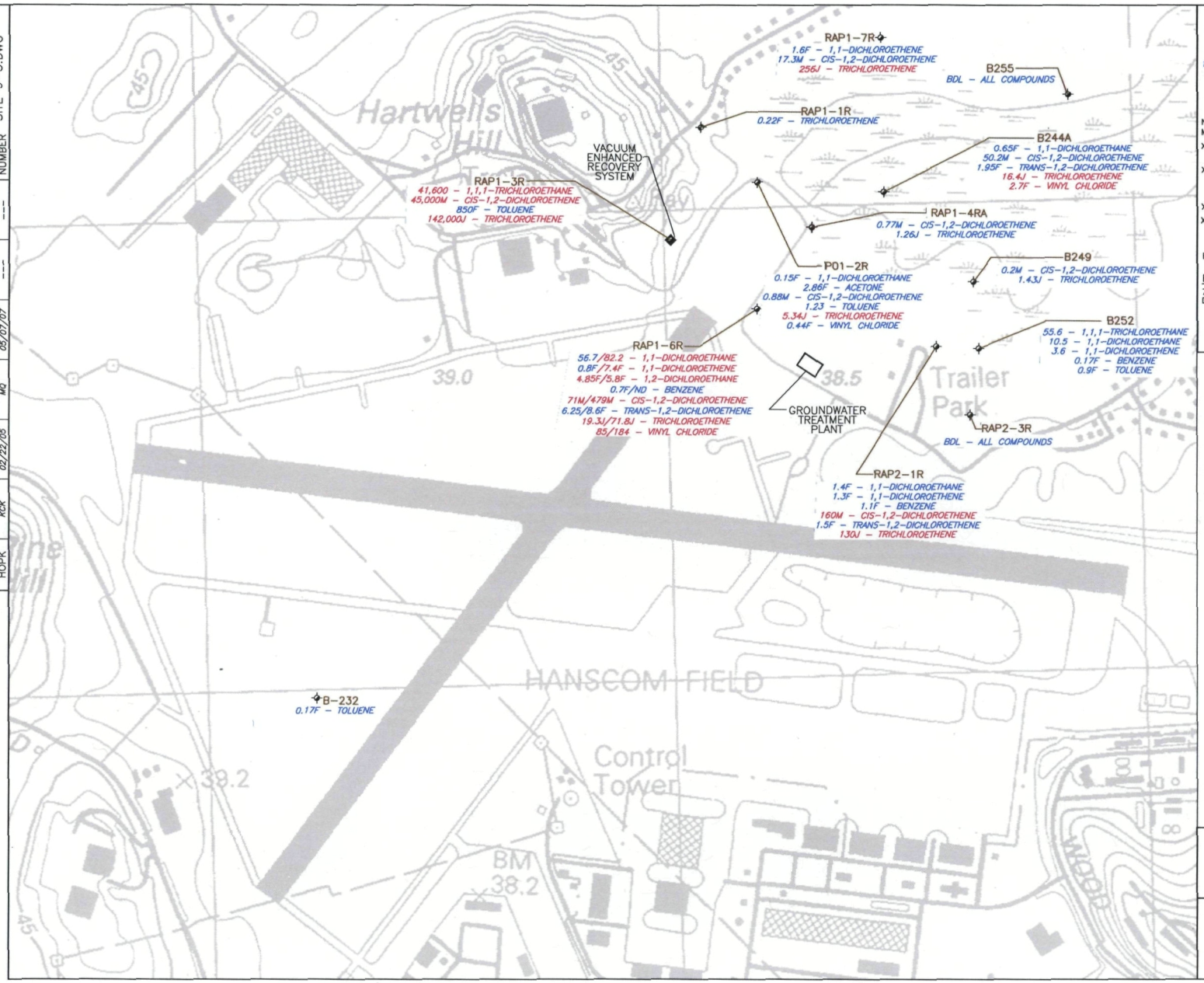

LEGEND

BEDROCK MONITORING WELL

EX.:RAP1-7R – WELL IDENTIFICATION

1.6F – 1,1-DICHLOROETHENE – COMPOUND DETECTED
17.3M – CIS-1,2-DICHLOROETHENE – COMPOUND DETECTED
256J – TRICHLOROETHENE – COMPOUND DETECTED EXCEEDS EPA MCL, MCP GW-1 OR MCP GW-2 STANDARDS

NOTES: ALL SAMPLE RESULTS SHOWN IN MICROGRAMS PER LITER (ug/l).

XX.X/XX.X = PRIMARY RESULT/DUPLICATE RESULT WHEN DUPLICATE SAMPLE COLLECTED.

XX.XM = COMPOUND PRESENT. REPORTED VALUE MAY BE BIASED HIGHER OR LOWER DUE TO MATRIX EFFECTS.

XX.XJ = COMPOUND PRESENT. ESTIMATED VALUE.

XX.XF – COMPOUND PRESENT. REPORTED CONCENTRTATION IS BETWEEN THE REPORTING LIMIT AND THE INSTRUMENT DETECTION LIMIT.

BDL = BELOW DETECTION LIMIT

REFERENCE:

7.5x15 MINUTE SERIES TOPOGRAPHIC MAP OF MAYNARD, MA DATED: 1987, SCALE 1:25,000.

SCALE
0 300 600 900 FEET

N

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
HOPK	KCK 02/22/05	MG 05/07/07	---	SITE 9-5.DWG

88C ELM STREET
HOPKINTON, MASSACHUSETTS
(508) 435-9561

FIGURE 12
VOCS IN GROUNDWATER
BEDROCK AQUIFER
NOVEMBER 2006
HANSCOM AFB
BEDFORD, MASSACHUSETTS

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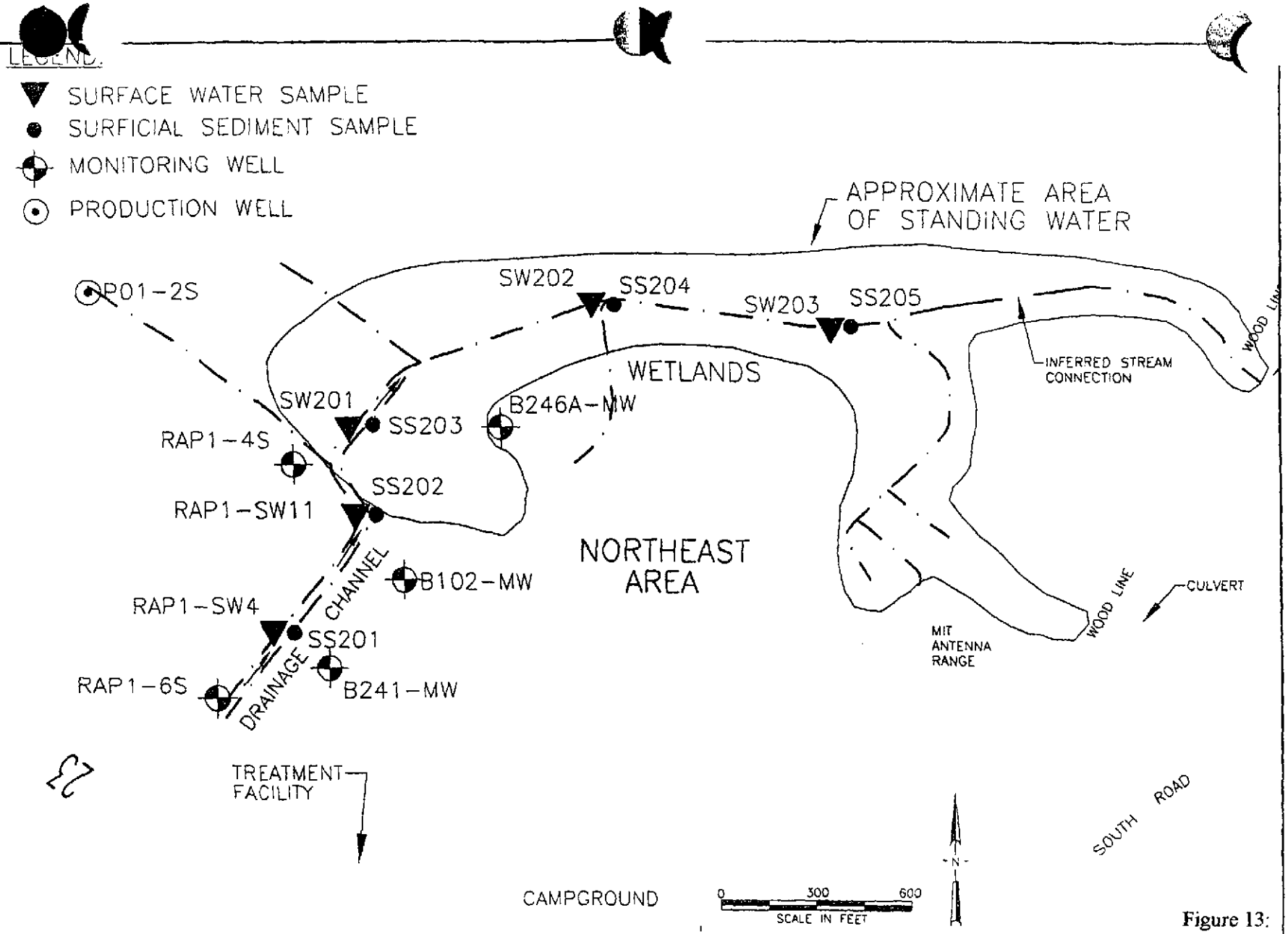


SOURCE:
Haley and Aldrich drawing "Northeast Area Features Location Plan", December 1996.

136808/8808F001.DWG

Figure 13:
OU1
Hanscom AFB
Wetland/Beaver Pond
Sampling Locations

CH2MHILL

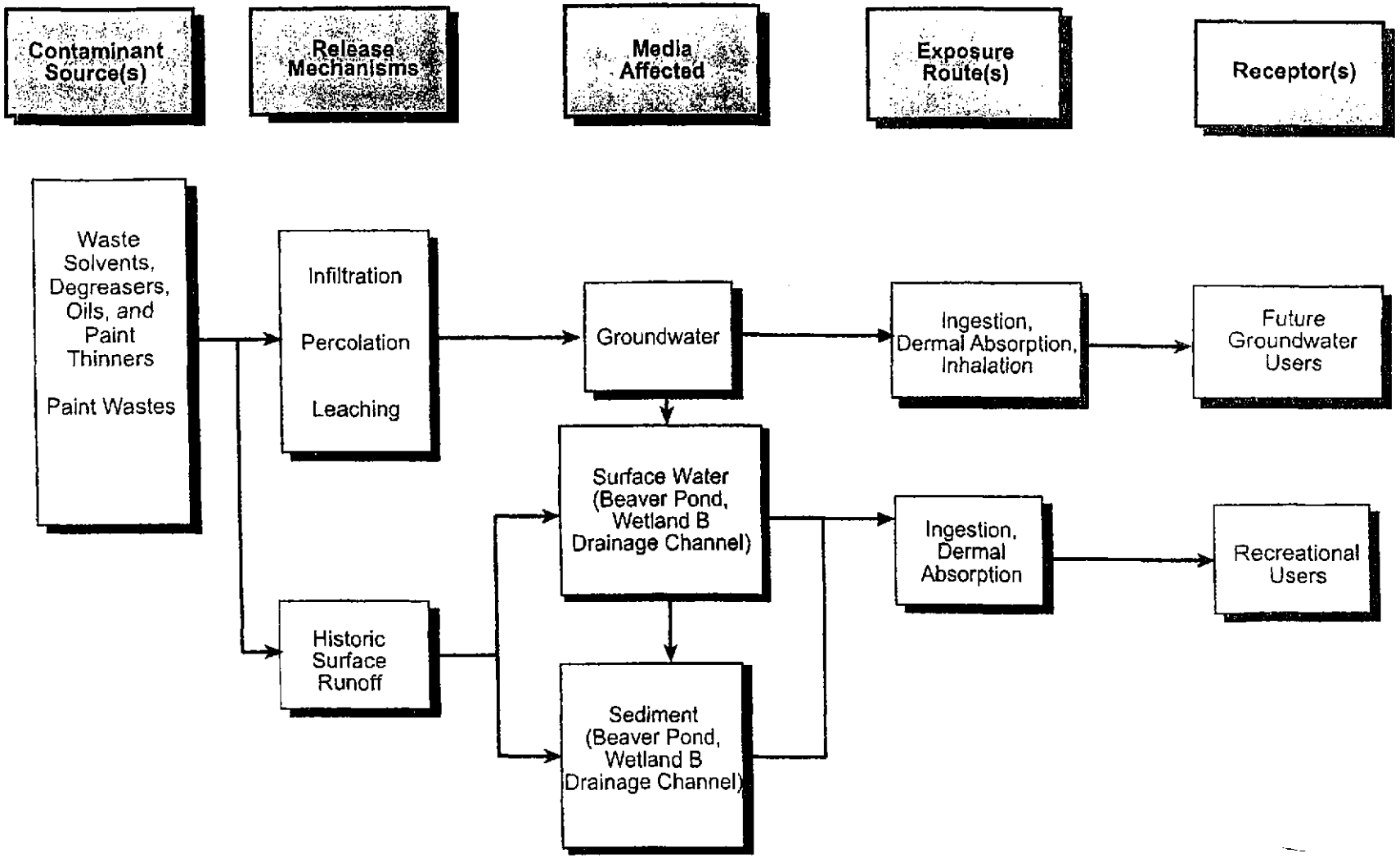


Figure 14:
Conceptual Site Model
Potential Human Exposure
OU-1, Hanscom AFB, MA

CH2MHILL

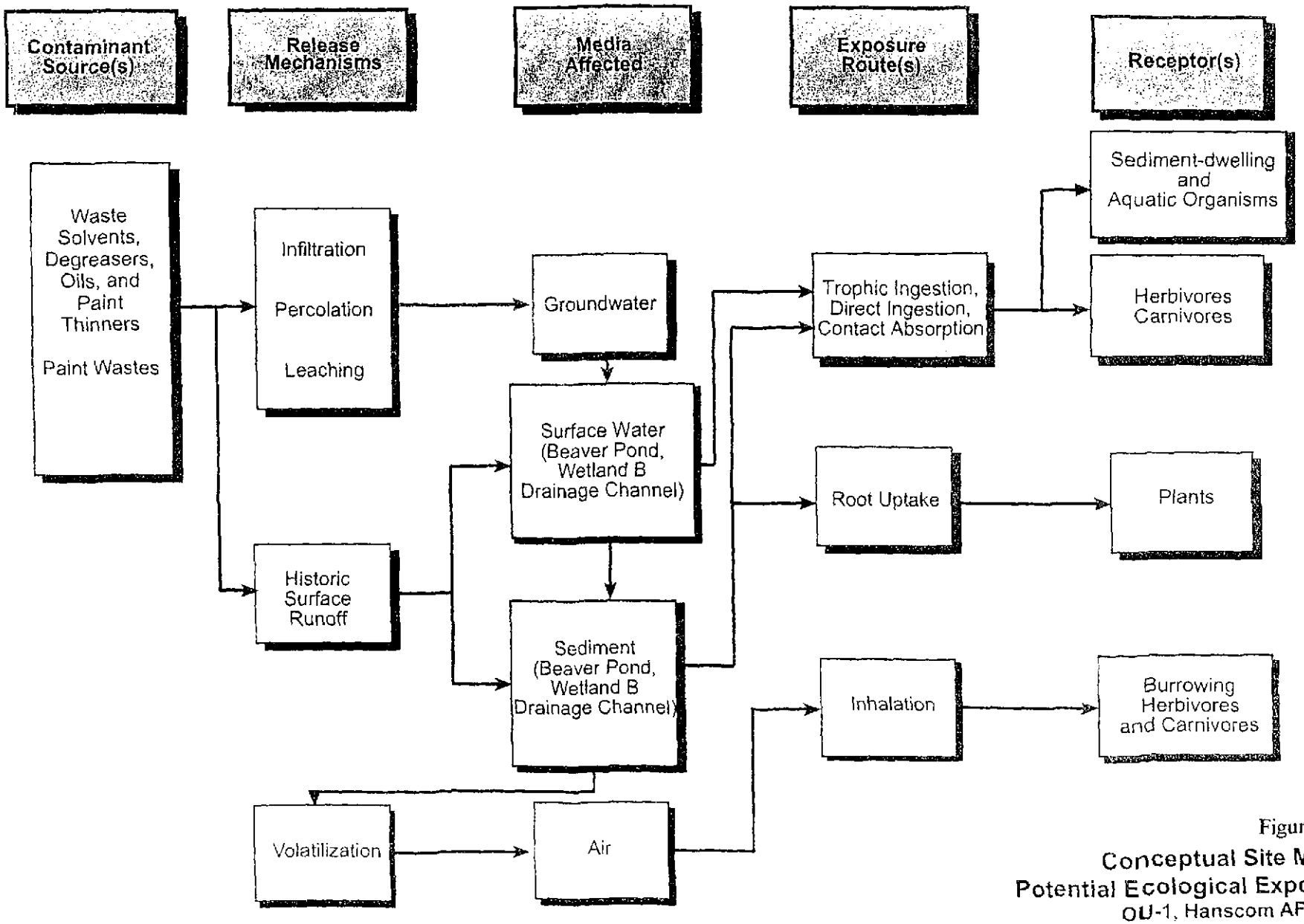


Figure 15:
Conceptual Site Model
Potential Ecological Exposure
OU-1, Hanscom AFB, MA

CH2MHILL

MA DEP - Bureau of Waste Site Cleanup

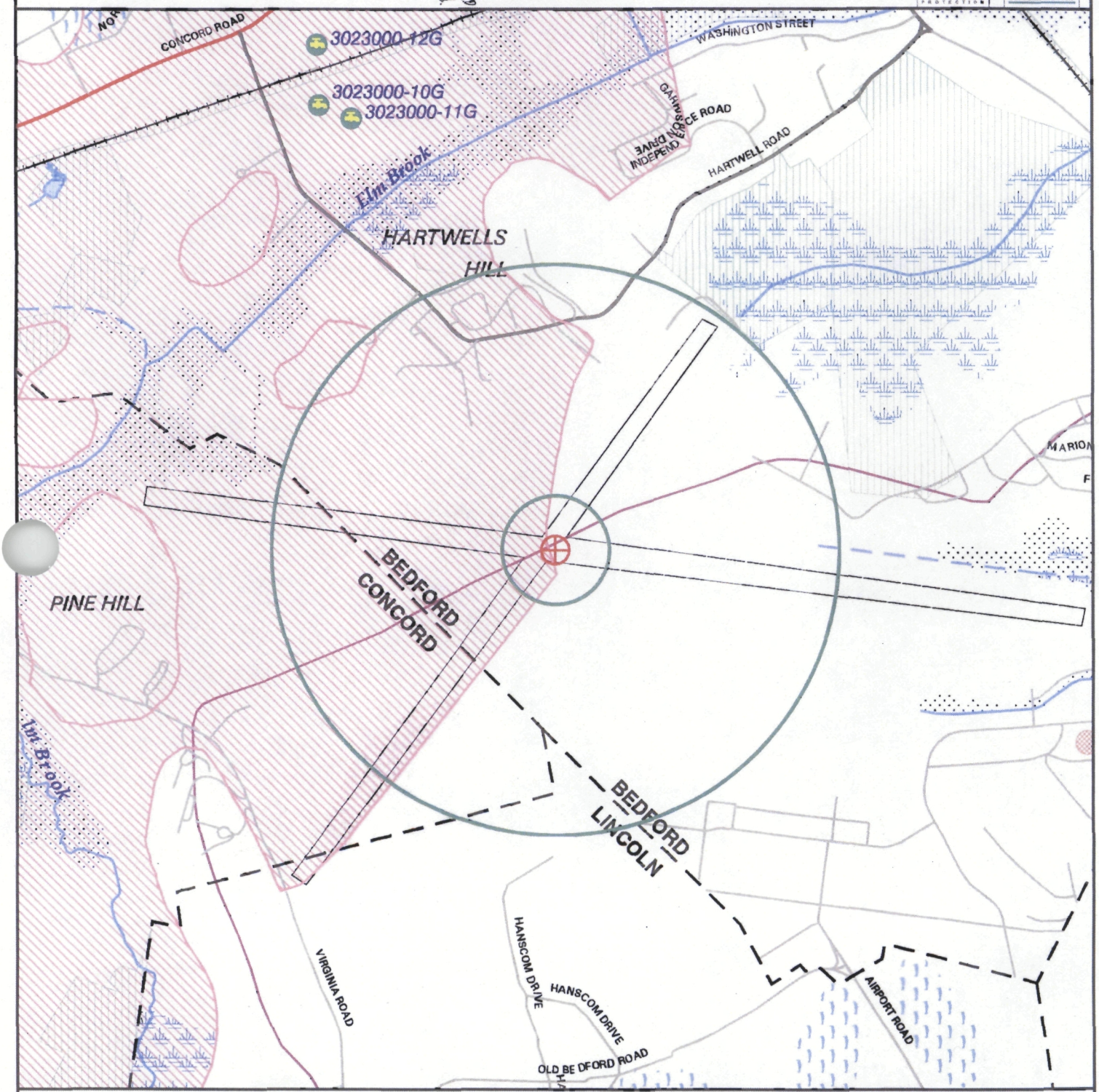
Site Scoring Map: 500 feet & 0.5 Mile Radii

SITE NAME:
Site Scoring Map
scom AFB
379n 217332ew

Site Location

The information shown on this map is the best available at the date of printing. Please refer to the data source descriptions document.

MASS GIS — Office of Geographic and Environmental Information
Massachusetts Executive Office of Energy & Environmental Affairs



Roads: Limited Access, Divided, Major Road, Connector, Street, Track, Trail
Boundaries: Town, County, DEP Region; Train; Powerline; Pipeline; Aqueduct
Basins: Major, Sub; Streams: Perennial, Intermittent, Man Made Shore, Dams
Potentially Productive Aquifers: Medium,High Yield
Non-Potential Drinking Water Source Area: Medium,High Yield

EPA Sole Source Aquifer; FEMA 100-year floodplain
Public Water Supplies: Ground,Surface,Non Community
Approved Zone2; IWPA; Surface Water Supply Zone A
Hydrography: Water Features,Public Surface Water Supply
Wetlands: Fresh,Salt,NHESP Wetlands Habitat
Protected Open Space; ACEC
DEP Permitted Solid Waste Facilities; Certified Vernal Pools

N NE E SE S SW W NW

SCALE 1:15000

0 1/2 MILES
0 1/2 KILOMETERS

June 20, 2007

FIGURE 16

Figure 17 OU-1 Historical LTM Results for RAP1-3R via Off-site Laboratory

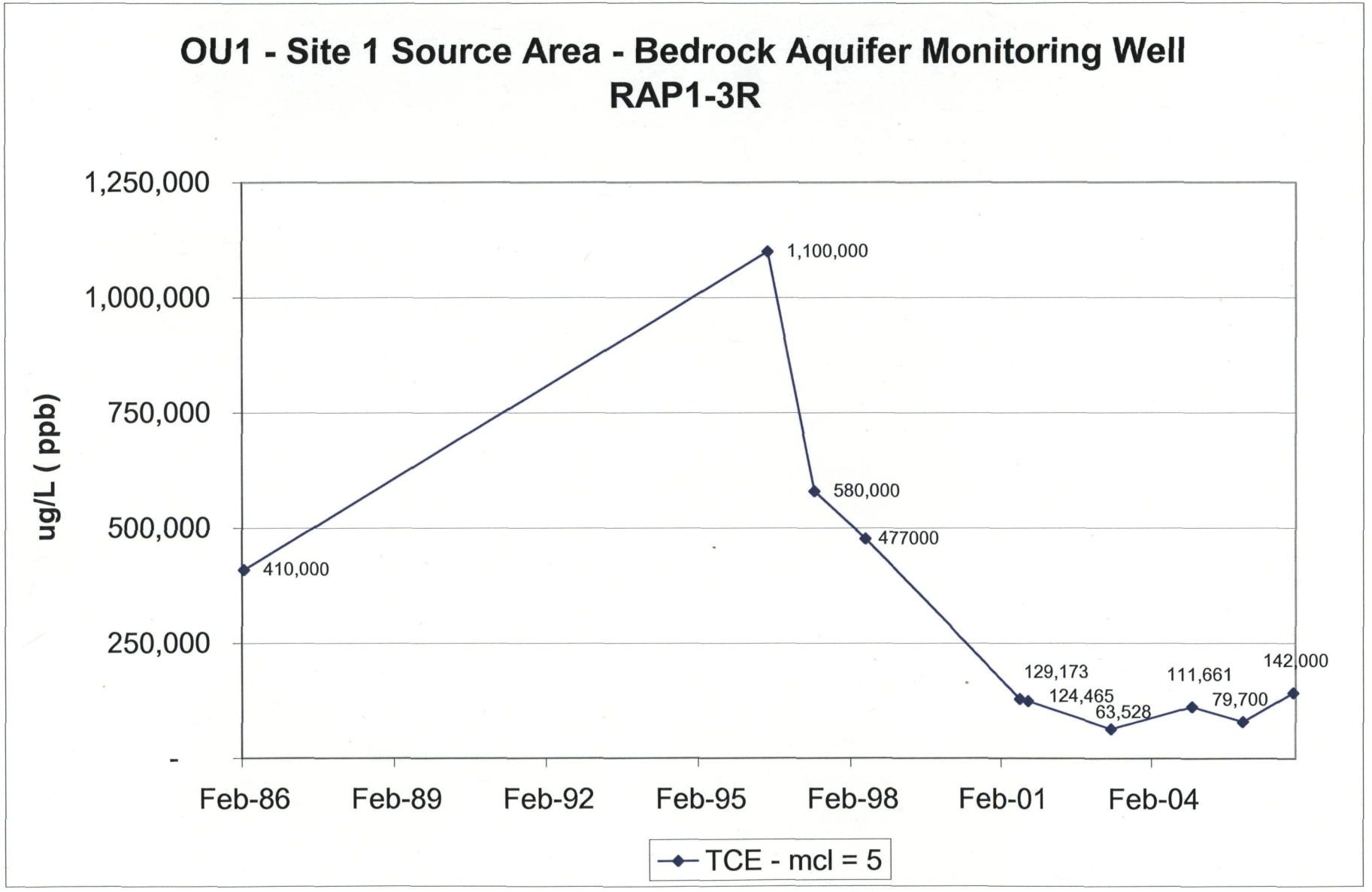
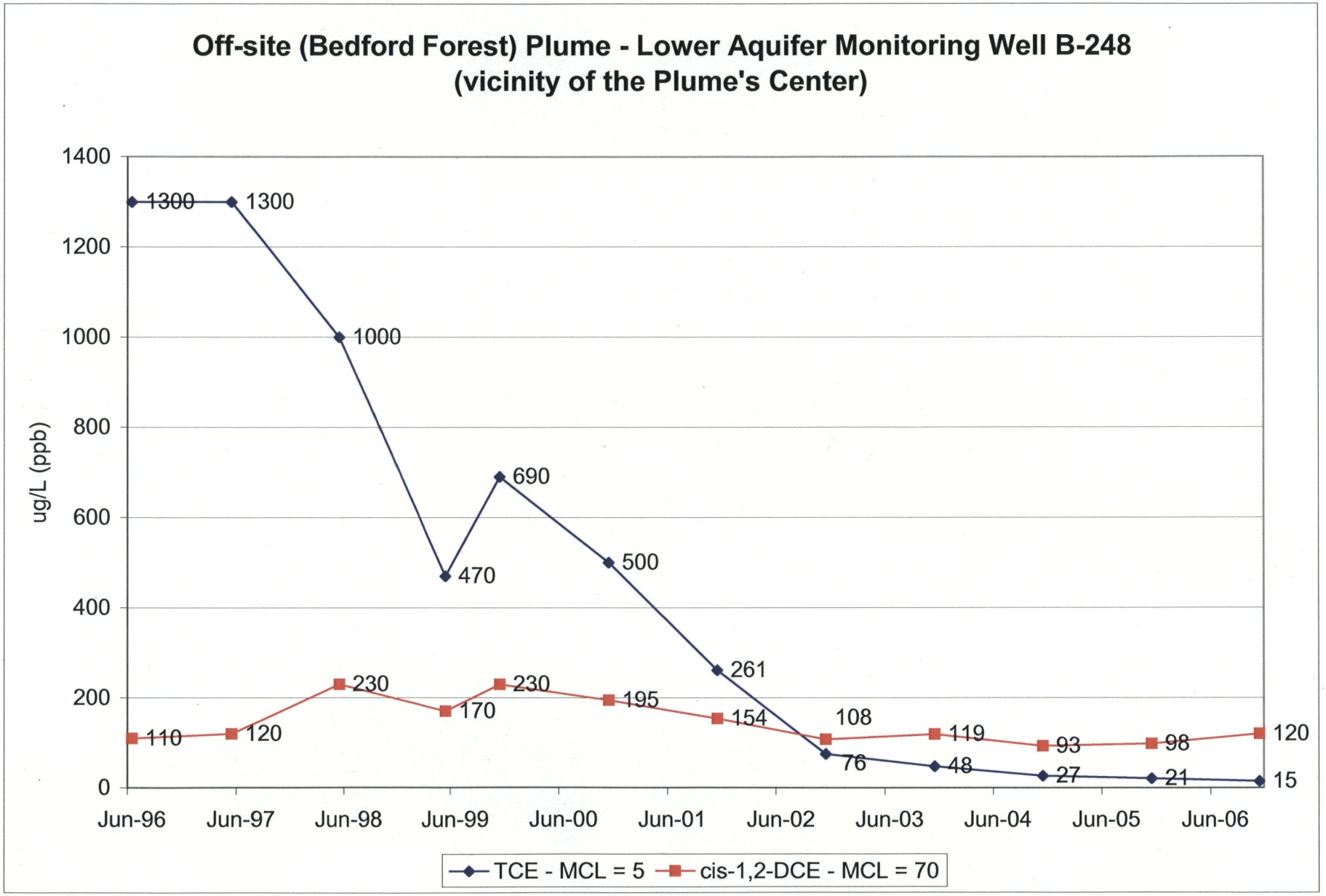


FIGURE 18 - OU1 Historical LTM Results for B-248 via Off-site Laboratory



APPENDIX

A

Appendix A – Administrative Record Index

SECTION 1: PRELIMINARY ASSESSMENTS

CORRESPONDENCE FOLDERS

DOCUMENTS:

No. 34: *Historical Information Folder, Hanscom AFB Plans and 2 Aerial Photographs;* prepared by Hanscom AFB; circa April 1951 (Basewide)

No. 1: *IRP Phase I—Record Search;* prepared by JRB Associates; August 1984 (Basewide)

No. 241: *Final Hazard Ranking System Package (REV 3.0), Hanscom AFB;* prepared by Halliburton NUS Environmental Corporation; April 1993 (Basewide)

No. 327: *Aerial Photographic Analysis, Hanscom AFB, Bedford, MA;* prepared by Lockheed Environmental Systems & Technologies Co., June 1998 (Basewide)

No. 408: *Report of Investigation: The Presence of Biological and Chemical Warfare Materiel at Hanscom Air Force Base;* prepared by Simulation Technologies, Inc., July 1999 (Basewide)

SECTION 2: SITE INSPECTIONS

CORRESPONDENCE FOLDERS

DOCUMENTS:

No. 3: *Hydrogeologic Investigation—Final Report;* prepared by Weston Consultants; April 1983 (IRP Sites 1, 2, 3, and 5)

No. 4: *Supplemental Hydrogeologic Investigation;* prepared by Weston Consultants; September 1984 (IRP Sites 1, 2, 3, and 5)

No. 91: *Final Site Safety and Health Plan (SSHP) for Investigation of Suspected Hazardous Waste Sites;* prepared by LAW Environmental, April 1991 (IRP Sites 16 through 20)

No. 94: *Final Chemical Data Acquisition Plan for Investigation of Suspected Hazardous Waste Sites;* prepared by LAW Environmental, April 1991 (IRP Sites 16 through 20)

No. 117: *Analytical Results Report for Investigation of Suspected Hazardous Waste Sites;* prepared by LAW Environmental, November 1991 (IRP Sites 16 through 20)

No. 141: *Site Inspection Report for Investigation of Suspected Hazardous Waste Sites*; prepared by LAW Environmental, July 1993 (IRP Sites 16 through 20)

No. 279-A: *Final Report, Basewide Hydrogeological Survey;* prepared by RUST Environmental & Infrastructure, Inc.; January 1997 (IRP Sites 1 through 22)

No. 279-B: *Basewide Hydrogeological Study Task 5—IRPIMS Data Entry;* prepared by RUST Environmental & Infrastructure, Inc., April 1997 (Basewide)

No. 279-C: *Site Safety and Health Plan, Basewide Hydrogeological Investigation;* prepared by RUST Environmental & Infrastructure, Inc., December 1994 (Basewide)

No. 396-1: *Request for Determination of Applicability Wetland Boundaries, Hanscom AFB - Bedford, MA*; prepared by LEC Environmental Consultants, Inc.; February 1995 (Basewide)

SECTION 3: REMOVAL ACTIONS

CORRESPONDENCE FOLDERS

DOCUMENTS:

IRP Site 1 Removal Actions:

No. 55: *Construction Specifications, Site 1 Soil Removal and Site Improvement*; prepared by Haley & Aldrich, Inc.; April 1987 (IRP Site 1)

No. 40: *IRP Phase IV—Detailed Design Cost Estimate, Site 1 Soil Removal;* prepared by Haley & Aldrich, Inc.; July 1987 (IRP Site 1)

No. 74: *Preconstruction Submittal with Comments, Site Specific Quality Management Program;* prepared by Enroserv, April 1988 (IRP Site 1)

No. 130: *Site 1 Soil Removal and Site Improvement Project Photographs; taken* by Enroserv, 1988 (IRP Site 1)

No. 36: *Survey Notebook, Soil Removal at Site 1*; prepared by Nelson Engineering, July 1988 (IRP Site 1)

IRP Sites 2 and 3 Removal Actions:

No. 51: *IRP Drum Removal Phase I, Pre-Construction Submittals;* prepared by Hydro-Dredge, Inc., 1987 (IRP Sites 2 &3)

No. 54-1: *Construction Specifications, IRP Drum Removal Phase*; prepared by Haley & Aldrich, Inc., April 1987 (IRP Sites 2 &3)

No. 54-2: *Detailed Design Cost Estimate (IRP Drum Removal Project)*; prepared by Engineering-Science, May 1987 (IRP Sites 2 &3)

No. 52: *IRP Drum Removal—Phase I, Chemical Quality Management Plan and Lab Protocol;* prepared by Hydro-Dredge, October 1987 (IRP Sites 2 &3)

No. 328: *Survey Notebook, Drum Removal for Sites 2 and 3*; May 1989 (IRP Sites 2 &3)

No. 132: *Drum Removal (Sites 2 and 3) Project Photographs; taken* by Hydro-Dredge, Inc., 1987-8 (IRP Sites 2 &3)

SECTION 4: REMEDIAL INVESTIGATIONS

CORRESPONDENCE FOLDERS

DOCUMENTS:

No. 225: *IRP Phase IV-A--Hanscom AFB Area 1 Remedial Investigation Data Document;* prepared by Haley & Aldrich, Inc.; February 1987 (Area 1—IRP Sites 1, 2, 3/5, and 4)

No. 27: *IRP Phase IV-A--Hanscom AFB Area 1, Appendix F; Architect/Engineer's Remedial Investigation Interpretive Report;* prepared by Haley & Aldrich, Inc.; May 1988 (Area 1—IRP Sites 1, 2, 3/5, and 4)

No. 72: *Long Term Monitoring Report—Rounds 1 through 3*; prepared by Haley & Aldrich, Inc.; February 1989 (Area 1—IRP Sites 1, 2, 3/5, and 4)

SECTION 4: REMEDIAL INVESTIGATIONS (CONT.):

No. 335-3: *QA/QC Plan (*associated with Joint AF/EPA/Tufts University ETI Project)*;* prepared by Spectrum Analytical, Inc., December 1994 (Operable Unit 1)

No. 357: *Data Usability Assessment;* prepared by CH2M Hill; August 1995 (Basewide)

No. 259-1: *Memorandum on Shawsheen River Chronic Toxicity Test Results;* prepared by US Environmental Protection Agency Northeast Regional Laboratory; December 1995 (Basewide)

No. 259-2: *Analytical Results of Sampling Shawsheen River at USGS Gaging Station;* prepared by Metcalf & Eddy Inc.; December 1995 (Basewide)

No. 259-3: *Hanscom AFB Stormwater Quality Testing Program;* prepared by Rizzo Associates, Inc.; January 1996 (Basewide)

No. 256: *Soil Gas Survey, Hanscom AFB, Runway #23 Approach*; prepared by Kestrel Drilling and Remediation, February 1996 (OU-1/IRP Site 20)

No. 242: *Human Health Risk Assessment Work Plan—Final Report;* prepared by CH2M Hill; July 1996 (Basewide)

No. 243: *Ecological Risk Assessment Methodology and Problem Formulation—Final Report;* prepared by CH2M Hill; July 1996 (Basewide)

No. 265: *Final Sampling and Analysis Plan, OU-1;* prepared by CH2M Hill; August 1996

No. 335-4: *Quality Assurance Program Plan (*associated with Joint AF/EPA/Tufts University ETI Project)*;* prepared by Phoenix Environmental Laboratories, Inc., August 96 (Operable Unit 1)

No. 335-2 *5 each Laboratory Reports for QA Analysis of OU-1Soil Samples associated with Joint AF/EPA/Tufts University ETI Project);* complied by Hanscom AFB, September 1996

No. 335-6: *Transmittal #1 of Off-Site Laboratory Data for QA Analysis of OU-1 Samples associated with Joint AF/EPA/Tufts University ETI Project);* complied by Hanscom AFB, October 1996

No. 281: *Workplan for Groundwater Modeling at Operable Unit 1 (Final Draft);* prepared by CH2M Hill; February 1997

No. 277: *Final – Work Plan for Direct Push Monitoring Point Assessment*; prepared by Applied Research Associates, April 1997 (OU-1 & IRP Site 21)

No. 335-8: *Hanscom AFB Sample Data Package for Joint AF/EPA/Tufts University ETI Project);* prepared by Tufts University; May 1997 (Operable Unit 1)

No. 298: *Groundwater Flow Model Report, Operable Unit 1 (Draft);* prepared by CH2M Hill; July 1997

No. 250-1: *Final Report, Comprehensive Ecological Analysis, Volume 1;* prepared by LEC Environmental Consultants, Inc.; August 1997 (Basewide)

No. 250-2: *Final Report, Comprehensive Ecological Analysis, Volume 2;* prepared by LEC Environmental Consultants, Inc.; August 1997 (Basewide)

SECTION 4: REMEDIAL INVESTIGATIONS (CONT.):

No. 335-7: *Transmittal #2 of Off-Site Laboratory Data for QA Analysis of OU-1 Samples associated with Joint AF/EPA/Tufts University ETI Project);* complied by Hanscom AFB, November 1997

No. 307-1: *Solute Transport Model Setup and Calibration Report, Operable Unit 1 (Draft);* prepared by CH2M Hill; December 1997

No. 312: *OU-1 Field Report;* prepared by CH2M Hill; January 1998

No. 335-5: Video Tape, *Field Analytics: The Key to Cost Effective Site Cleanup;* produced by Tufts University in association with Joint AF/EPA/Tufts University ETI Project, January 1998 (Operable Unit 1)

No. 307-2: *Presentation Materials - Operable Unit 1 Groundwater Flow and Solute Transport Model March 11, 1998 Meeting;* prepared by CH2M Hill; March 1998

No. 335-1: *Innovations in Site Characterization: Case Study, Hanscom AFB OU-1 (Sites 1, 2, & 3);* prepared by the US Environmental Protection Agency; September 1998

No. 343: *Technical Memorandum: Soil to Groundwater Pathway, OU-1;* prepared by CH2M Hill; December 1998

No. 315-1: *Ecological Risk Assessment, Operable Unit 1 (Final);* prepared by CH2M Hill; January 1999

No. 250-3: *Supplement to Comprehensive Ecological Analysis, Volume 3 – Riverfront Area Analysis;* prepared by LEC Environmental Consultants, Inc.; February 1999 (Basewide)

No. 315-2: Technical Memorandum – *Hanscom AFB Operable Unit 1 Ecological Risk Assessment Follow-up Sampling;* prepared by CH2M Hill, December 2000

SECTION 5: FEASIBILITY STUDIES

CORRESPONDENCE FOLDERS

DOCUMENTS:

No. 364: *Final—Focused Feasibility Study, OU-1*; prepared by CH2M Hill; May 2000

No. 534: *Final—Revised Focused Feasibility Study, OU-1*; prepared by 66MSG/CEGV, Hanscom AFB, May 2007

SECTION 6: PROPOSED PLANS

CORRESPONDENCE FOLDERS

DOCUMENTS:

No. 5: *Recommendations & Cost Estimates for Development of Remedial Action Plans at Hanscom AFB;* prepared by Dynamac Corporation; May 1985 (Basewide)

No. 28: *IRP Phase IV-A—Hanscom AFB Area 1, Intro to Remedial Action Plans;* prepared by Haley & Aldrich, Inc.; May 1988 (Area 1)

No. 29: *IRP Phase IV-A—Hanscom AFB Area 1, Remedial Action Plan, Site 1*; prepared by Haley & Aldrich, Inc.; May 1988 (IRP Site 1)

No. 30: *IRP Phase IV-A—Hanscom AFB Area 1, Remedial Action Plan, Site 2;* prepared by Haley & Aldrich, Inc.; May 1988 (IRP Site 2)

SECTION 6: PROPOSED PLANS (CONT.):

No. 31: *IRP Phase IV-A—Hanscom AFB Area 1, Remedial Action Plan, Site 3/5*; prepared by Haley & Aldrich, Inc.; May 1988 (IRP Site 3/5)

No. 33: *IRP Phase IV-A—Hanscom AFB Area 1Environmental Assessment;* prepared by Haley & Aldrich, Inc.; May 1988 (Area 1—IRP Sites 1, 2, 3/5, and 4)

No. 365: *Interim Proposed Plan for OU-1;* prepared by CH2M Hill; June 2000

No. 383: *Operable Unit 1 Interim Proposed Plan—Public Hearing Transcript;* prepared by G&M Hoey Court Reporters, 28 June 2000

No. 535: *Proposed Plan for OU-1;* prepared by 66mSG/CEGV, Hanscom AFB; May 2007

SECTION 7: RECORDS OF DECISION

CORRESPONDENCE FOLDERS

DOCUMENTS:

No. 35: *Decision Document—Area 1 (Sites 1–5);* prepared by Hanscom AFB, April 1988 (Area 1—IRP Sites 1, 2, 3/5, and 4)

No. 103: *Decision Document—No Further Action*; prepared by Haley & Aldrich, Inc., October 1991 (IRP Site 5)

No. 126: *Decision Document (No Further Response Action Planned);* prepared by Hanscom AFB; April 1992 (IRP Sites 1, 2, and 3)

No. 194: *Draft No Further Response Action Planned Decision Document for Site 20*; prepared by EA Engineering, Science, and Technology, September 1994 (OU-1/IRP Site 20)

No. 193: *No Further Response Action Planned Decision Document for Site 19*; prepared by EA Engineering, Science, and Technology, September 1994 (OU-1/IRP Site 19)

No. 390: *Interim Record of Decision Operable Unit 1*; prepared by CH2M Hill, November 2000 (OU-1/IRP Sites 1, 2, 3, 5, & 20)

No. 536: *Draft Final Record of Decision NPL Operable Unit 1*; prepared by 66mSG/CEGV, Hanscom AFB; June 2007 (OU-1/IRP Sites 1, 2, & 3)

SECTION 8: POST RECORDS OF DECISION (RAP/IROD)

CORRESPONDENCE FOLDERS

DOCUMENTS:

Five-Year Reviews

No. 297: *Five-Year Review Report #1, Hanscom AFB Superfund Site (OU2-Site 4)*; prepared by the US Environmental Protection Agency, September 1997

No. 453: *Final - Second Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site*; prepared by Environmental Flight, Hanscom AFB, August 2002 (Operable Units 1/2/3)

SECTION 8: POST RECORDS OF DECISION (RAP/IROD) (CONT.):

Operable Unit 1 Remedial Action Design & Construction

No. 537: *Third Five-Year Review Report, Hanscom Field/Hanscom AFB Superfund Site*; prepared by 66MSG/CEGV, Hanscom AFB, August 2007 (Operable Units 1/2/3)

No. 37-1: *Detailed Design Cost Estimate, Groundwater Treatment System*; prepared by Haley & Aldrich, Inc., o/a February 1987 (Operable Unit 1)

No. 37-2: *Soil Flushing and Stripping Review*; prepared by Engineering-Science; February 1987 (Operable Unit 1)

No. 153-1: Recovery and Observation Well Records (PT & PO Series) for Sites 1, & 2, Installed July 1987 by Haley & Aldrich, Inc., September 1987 (Operable Unit 1)

No. 58: *Subsurface Investigation and Recommendations for Groundwater Treatment Facility*; prepared by Haley & Aldrich, Inc.; December 1987 (Operable Unit 1)

No. 59: *Air Stripping Column Design Report;* prepared by Engineering Science, Inc., December 1987 (Operable Unit 1)

No. 60: *Groundwater Treatment Facility Comparison of Vapor Off-Gas Treatment Technologies*; prepared by Engineering Science, Inc., January 1988 (Operable Unit 1)

No. 38-1: *Design Analysis Report, Stage II Groundwater Treatment, Volume 1 of 2;* prepared by Haley & Aldrich, Inc., June 1988 (Operable Unit 1)

No. 38-2: *Design Analysis Report, Stage II Groundwater Treatment, Volume 2 of 2;* prepared by Haley & Aldrich, Inc., June 1988 (Operable Unit 1)

No. 53: *Construction Specifications, Groundwater Treatment Facility—Stage II;* prepared by Haley & Aldrich, Inc., June 1988 (Operable Unit 1)

No. 136-1: *Construction of Groundwater Treatment System Project Photographs*; taken by R. Zoppo Co.; 1988 - 1990 (Operable Unit 1)

No. 136-2: Observation and Monitoring Well Records for Sites 1, 2 &3, Installed October 1989 by R. Zoppo Co.; March 1990 (Operable Unit 1)

No. 77: *Operation & Maintenance of Groundwater Treatment System—Conceptual Operation & Maintenance Specification Outline*; prepared by Haley & Aldrich, Inc., May 1990 (Operable Unit 1)

No. 82: *Operation & Maintenance of Groundwater Treatment System—Prefinal Operation & Maintenance Specifications;* prepared by Haley & Aldrich, Inc., June 1990 (Operable Unit 1)

No. 84: *Operation & Maintenance of Groundwater Treatment System—Engineer's Estimate and Proposed Staffing*; prepared by Haley & Aldrich, Inc., June 1990 (Operable Unit 1)

No. 260: *Report on Bedrock Pump Test Review*; prepared by Haley & Aldrich, Inc.; June 1990 (Operable Unit 1)

No. 83: *Operations and Maintenance of Groundwater Treatment System—Final Engineers' Estimate;* prepared by Haley & Aldrich, September 1990 (Operable Unit 1)

SECTION 8: POST RECORDS OF DECISION (RAP/IROD) (CONT.):

Operable Unit 1 Remedial Action Design & Construction (Cont.)

No. 112: *Specifications—Operation & Maintenance of Groundwater Treatment Facility;* prepared by the Army Corps of Engineers—Omaha and Haley & Aldrich, Inc., September 1990 (Operable Unit 1)

No. 86: *Operation & Maintenance of Groundwater Treatment System—Revised Final Engineer's Estimate*; prepared by Haley & Aldrich, Inc., October 1990 (Operable Unit 1)

No. 120: *Remediation of Iron Bacteria Condition at Groundwater Treatment Facility*; prepared by Haley & Aldrich, Inc., January 1992 (Operable Unit 1)

No. 202: *Specifications for Chemical Cleaning Contract (Iron Bacteria Study);* prepared by Haley & Aldrich, Inc., July 1992 (Operable Unit 1)

No. 156: *Engineering Audit Report, Groundwater Treatment Facility (Iron Bacteria Study);* prepared by The Water Tech. Group, March 1993 (Operable Unit 1)

No. 176: *DE Plant and Analytical Testing Interpretation (Iron Bacteria Study);* prepared by The Water Tech. Group, November 1993 (Operable Unit 1)

No. 246-1: *Advanced Oxidation Process Pilot Test Report;* prepared by Haley & Aldrich, Inc., March 1995 (Operable Unit 1)

No. 246-2: *Design Analysis for Groundwater Treatment Modifications;* prepared by Haley & Aldrich, Inc., May 1995 (Operable Unit 1)

No. 246-3: *Draft Specifications for Groundwater Treatment Modifications;* prepared by Haley & Aldrich, Inc., June 1995 (Operable Unit 1)

No. 246-4: *Proposal for Modifications to Groundwater Treatment Facility;* prepared by PSG, Inc., August 1995 (Operable Unit 1)

No. 153-2: *Memorandum: Summary of Pump Test Data for PT2-RA (BIW #4);* prepared by Haley & Aldrich, Inc., April 1997 (Operable Unit 1)

No. 293-B: *Demonstration of Vacuum-Enhanced Recovery (VER) Technology Proposal (Final)*; prepared by Geraghty & Miller, June 1997 (Operable Unit 1/IRP Site 1)

No. 293-A: *Technical Work Plan for Demonstration of Vacuum-Enhanced Recovery (VER) Technology (Final)*; prepared by Geraghty & Miller, September 1997 (Operable Unit 1/IRP Site 1)

No. 305: *Work Plan, Operable Unit 1 Monitoring Well Cluster Installation (Final);* prepared by CH2M Hill; February 1998

No. 332: *OU-1 Monitoring Well Cluster Installation;* prepared by CH2M Hill; July 1998

No. 293-C: *Demonstration of Vacuum Enhanced Recovery Technology at Site 1, Hanscom AFB, MA (technical report);* prepared by Arcadis Geraghty & Miller, June 2000 (Operable Unit 1)

No. 293-D: *Performance Review, Technology Demonstration Project, Vacuum Enhanced Recovery of DNAPLs, Hanscom AFB, MA;* prepared by Arcadis Geraghty & Miller, September 1998 (Operable Unit 1/IRP Site 1)

SECTION 8: POST RECORDS OF DECISION (RAP/IROD) (CONT.):

Operable Unit 1 Remedial Action Design & Construction (Cont.)

No. 362-1: *Demonstration Plan & Work Plan for In-Situ Substrate Addition to Create Reactive Zones for Treatment of Chlorinated Aliphatic Hydrocarbons (Final)*; prepared by Arcadis Geraghty & Miller; March 2000 (Operable Unit 1/IRP Site 1)

No. 362-2: *Demonstration/Work Plan Comment Responses*; prepared by Arcadis Geraghty & Miller; March 2000 (Operable Unit 1/IRP Site 1)

No. 398-2: Analytical Data Reports for Soil samples from Boring RAP1-7T at the Bedford Community Gardens; prepared by IT Corporation; August 2000 (Operable Unit 1)

No. 493-1: *Remedial Process Optimization (RPO) Scoping Visit Information Package and Final Report;* prepared by Parsons Engineering Science, October 2000 (OU-1, OU-2, OU-3 & MCP Sites)

No. 398-1: *Final - Monitoring Well Installation Report* (RAP1-7S & T at the Bedford Community Gardens*) for Long-Term Monitoring of OU-1*; prepared by IT Corporation; November 2000

No. 480-2: Analytical Data Reports for June 2001 Baseline Samples for Permanganate Addition Pilot Study; prepared by IT Corporation; June 2001 (Operable Unit 1/IRP Site 1)

No. 494: *Remedial Process Optimization (RPO) Handbook;* prepared by AFCEE, June 2001

No. 480-1: Permanganate Addition Pilot Study Report for Remediation of OU1/IRP Site1; prepared by Shaw Environmental, Inc., September 2003

No. 493-2: *Remedial Process Optimization (RPO) Inventory & Prioritization Report;* prepared by Earth Tech, Inc., March 2004 (OU-1, OU-2, OU-3 & MCP Sites)

No. 514: *Work Plan, Additional Interceptor Well at Operable Unit 1* (IW-11); prepared by Shaw Environmental, Inc., December 2005

No. 524: *Interceptor Well Installation Report for IW-11 at OU1;* prepared by Shaw Environmental, Inc., July 2006

Operable Unit 1 Remedial Action – Operation

No. 49: *IRP Phase IV-B--Recovered Groundwater Treatment System O&M Manual*; prepared by Haley & Aldrich, Inc.; April 1990 (Operable Unit 1)

No. 78: *Long Term Monitoring Program—Quality Control and Sampling Plan*; prepared by Haley & Aldrich, Inc., September 1990 (Operable Unit 1)

No. 97: *Proposal for Operation & Maintenance of Groundwater Treatment Facility—Volumes 1, 2, & 3, and Supplemental Information/Best & Final Offer*; prepared by Metcalf & Eddy, Inc., October 1990 (Operable Unit 1)

No. 75: *Start-up Phase Reports for Groundwater Treatment Facility Serving OU-1*; prepared by various authors, September 1990 – January 1991

No. 129: *O&M Contractor Plans (Transition, Quality Control, Site Access & Security, Labor, Operation, Maintenance, De-mobilization, Inventory, and Health and Safety) – 2 Volumes*; prepared by Metcalf & Eddy, Inc., June 1991 (Operable Unit 1)

SECTION 8: POST RECORDS OF DECISION (RAP/IROD) (CONT.):

Operable Unit 1 Remedial Action – Operation (Cont.)

No. 191: *Chemical Data Acquisition Plan for Long Term Monitoring;* prepared by Haley & Aldrich, Inc., December 1993 (Operable Unit 1)

No. 190: *Site Safety and Health Plan for Long Term Monitoring*; prepared by Haley & Aldrich, Inc., February 1994 (Operable Unit 1)

No. 285-1: *Briefing Report - Treatment Plant Performance Data & 1994 Groundwater Levels at Recharge Basins8*; prepared by Haley & Aldrich, Inc.; January 1995 (Operable Unit 1)

No. 255: *Chemical Data Acquisition Plan—Long Term Sampling Program;* prepared by Haley & Aldrich, Inc.; April 1996 (Operable Unit 1)

No. 206-B: *O&M Manual - SCADA System – Modifications to GW Treatment System – Volume 1 of 2*; prepared by Autocon Industries.; August 1996 (Operable Unit 1)

No. 206-C: *O&M Manual - SCADA System – Modifications to GW Treatment System – Volume 2 of 2*; prepared by Autocon Industries.; August 1996 (Operable Unit 1)

No. 385: *Technical Memorandum—Monitoring Well Network Evaluation*; prepared by Federal Facilities Superfund Section, 1 Oct 97 (Operable Unit 1)

No. 206-A: *IRP Phase IV-B—Recovered Groundwater Treatment System O&M Manual*; revised by Professional Services Group, Inc.; June 1998 (Operable Unit 1)

No. 285: *Monthly Discharge Monitoring Reports, 1991-1998*; prepared by Metcalf & Eddy, Inc. & compiled by Hanscom AFB, December 1998 (Operable Unit 1)

No. 354: *Monthly Operation & Discharge Monitoring Reports, 1999;* prepared by IT Corporation (Operable Unit 1)

No. 368: *Monthly Operation and Discharge Monitoring Reports, 2000*; prepared by IT Corporation (Operable Unit 1)

No. 363: *Health & Safety Plan: In-Situ Reductive Dechlorination Technology Demonstration;* prepared by Arcadis Geraghty & Miller; March 2000 (Operable Unit 1/IRP Site 1)

No. 345-1: *Final—Operation, Maintenance, and Monitoring of OU-1 and Maintenance of LF04 Quality Program Plan, Part 1- Environmental Health & Safety Plan*; prepared by IT Corporation, March 2000

No. 345-2: *Final—Operation, Maintenance, and Monitoring of OU-1 and Maintenance of LF04 Quality Program Plan, Part 2- Field Sampling Plan*; prepared by IT Corporation, March 2000

No. 345-3: *Final—Operation, Maintenance, and Monitoring of OU-1 and Maintenance of LF04 Quality Program Plan, Project Specific Quality Assurance Project Plan*; prepared by Universe Technologies Incorporated, October 2000

No. 423: *Monthly Operation and Discharge Monitoring Reports, 2001*; prepared by IT Corporation (Operable Unit 1)

No. 420: *Final - Environmental Health & Safety Plan for O, M & M of OU-1, Maintenance of OU-2 (Site 4), Removal Action at OU-3/Site 21 and Remedial Action at OU-3/Site 6;* prepared by IT Corporation, May 2001

SECTION 8: POST RECORDS OF DECISION (RAP/IROD) (CONT.):

Operable Unit 1 Remedial Action – Operation (Cont.)

No. 446: *Monthly Operation and Discharge Monitoring Reports, 2002*; prepared by IT Corporation (Operable Unit 1)

No. 419: *Final - Basewide Quality Assurance Project Plan (QAPP) with Amendment 1 for LTM at OU1, OU3/Sites 6 & 21, IRP Sites 13 & 22, and the FAFSUST Site* - 2 Volumes; prepared by IT Corporation, Revised January 2003

No. 471: *Monthly Summary Reports of Operation –OU-1 Groundwater Remediation System, 2003*; prepared by Hanscom AFB, monthly (Operable Unit 1)

No. 476: Final Report – ESTCP In-situ Substrate Addition to Create Reactive Zones for Treatment of Chlorinated Aliphatic Hydrocarbons: Hanscom AFB; prepared by Arcadis G&M, Inc., April 2003 (OU-1/IRP Site 1)

No. 486-1: *Monthly Summary Reports of Operation –OU-1 Groundwater Remediation System, 2004*; prepared by Hanscom AFB, monthly

No. 486-2: *Monthly Summary Reports of Operation –OU-1 Groundwater Remediation System, 2005*; prepared by Hanscom AFB

No. 486-3: *Monthly Summary Reports of Operation –OU-1 Groundwater Remediation System, 2006*; prepared by Hanscom AFB

No. 486-4: *Monthly Summary Reports of Operation –OU-1 Groundwater Remediation System, 2007*; prepared by Hanscom AFB

No. 533: *Focused Ground Water Flow and Transport Model, OU-1, Hanscom AFB, Bedford, MA;* prepared by CDW Consultants, Inc., May 2007 (Operable Unit 1)

Operable Unit 1 Remedial Action – Operation (Toxicity Reports)

No. 121-A: *Toxicological Evaluation of Treated Effluent, July 1991 Samples*; prepared by EnviroSystems, Inc., July 1991 (Operable Unit 1)

No. 121-B: *Toxicological Evaluation of Treated Effluent, October 1991 Samples*; prepared by EnviroSystems, Inc., October 1991 (Operable Unit 1)

No. 123: *Toxicity Evaluation of Treated Effluent, December 1991 Samples*; prepared by Springborn Laboratories, December 1991 (Operable Unit 1)

No. 122: *Toxicity Evaluation of Treated Effluent, December 1991 Samples*; prepared by Springborn Laboratories, January 1992 (Operable Unit 1)

No. 124: *Toxicity Evaluation of Treated Effluent, February 1992 Samples*; prepared by Springborn Laboratories, February 1992 (Operable Unit 1)

No. 139: *Toxicity Evaluation of Treated Effluent, May 1992 Samples*; prepared by Springborn Laboratories, May 1992 (Operable Unit 1)

No. 146: *Toxicity Evaluation of Treated Effluent, September 1992 Samples*; prepared by Springborn Laboratories, October 1992 (Operable Unit 1)

No. 147: *Toxicity Evaluation of Treated Effluent, November 1992 Samples*; prepared by Springborn Laboratories, December 1992 (Operable Unit 1)

SECTION 8: POST RECORDS OF DECISION (RAP/IROD) (CONT.):

Operable Unit 1 Remedial Action – Operation (Toxicity Reports-Cont.)

No. 161: *Toxicity Evaluation of Treated Effluent, February 1993 Samples*; prepared by Springborn Laboratories, March 1993 (Operable Unit 1)

No. 171: *Toxicity Evaluation of Treated Effluent, May 1993 Samples*; prepared by Springborn Laboratories, June 1993 (Operable Unit 1)

No. 172: *Toxicity Evaluation of Treated Effluent, August 1993 Samples*; prepared by Springborn Laboratories, September 1993 (Operable Unit 1)

No. 173: *Toxicity Evaluation of Treated Effluent, November 1993 Samples*; prepared by Springborn Laboratories, December 1993 (Operable Unit 1)

No. 179: *Toxicity Evaluation of Treated Effluent, February 1994 Samples*; prepared by Springborn Laboratories, March 1994 (Operable Unit 1)

No. 192: *Toxicity Evaluation of Treated Effluent, May 1994 Samples*; prepared by Springborn Laboratories, June 1994 (Operable Unit 1)

No. 200: *Toxicity Evaluation of Treated Effluent, August 1994 Samples*; prepared by Springborn Laboratories, August 1994 (Operable Unit 1)

No. 212: *Toxicity Evaluation of Treated Effluent, November 1994 Samples*; prepared by Springborn Laboratories, December 1994 (Operable Unit 1)

No. 227: *Toxicity Evaluation of Treated Effluent, February 1995 Samples*; prepared by Springborn Laboratories, March 1995 (Operable Unit 1)

No. 244: *Toxicity Evaluation of Treated Effluent, May 1995 Samples*; prepared by Springborn Laboratories, July 1995 (Operable Unit 1)

No. 247: *Toxicity Evaluation of Treated Effluent, August 1995 Samples*; prepared by Springborn Laboratories, October 1995 (Operable Unit 1)

No. 252: *Toxicity Evaluation of Treated Effluent, November 1995 Samples*; prepared by Springborn Laboratories, December 1995 (Operable Unit 1)

No. 261: *Toxicity Evaluation of Treated Effluent, February 1996 Samples*; prepared by Springborn Laboratories, March 1996 (Operable Unit 1)

No. 266: *Toxicity Evaluation of Treated Effluent, June 1996 Samples*; prepared by EnviroSystems, Inc., June 1996 (Operable Unit 1)

No. 271: *Toxicity Evaluation of Treated Effluent, August 1996 Samples*; prepared by EnviroSystems, Inc., August 1996 (Operable Unit 1)

No. 276: *Toxicity Evaluation of Treated Effluent, January 1997 Samples*; prepared by EnviroSystems, Inc., January 1997 (Operable Unit 1)

No. 289: *Toxicity Evaluation of Treated Effluent, March 1997 Samples*; prepared by EnviroSystems, Inc., March 1997 (Operable Unit 1)

SECTION 8: POST RECORDS OF DECISION (RAP/IROD) (CONT.):

Operable Unit 1 Remedial Action – Operation (Toxicity Reports-Cont.)

No. 292: *Toxicity Evaluation of Treated Effluent, May 1997 Samples*; prepared by EnviroSystems, Inc., May 1997 (Operable Unit 1)

No. 301: *Toxicity Evaluation of Treated Effluent, September 1997 Samples*; prepared by EnviroSystems, Inc., September 1997 (Operable Unit 1)

No. 303: *Toxicity Evaluation of Treated Effluent, November 1997 Samples;* prepared by EnviroSystems, Inc., November 1997 (Operable Unit 1)

No. 316: *Toxicity Evaluation of Treated Effluent, March 1998 Samples;* prepared by EnviroSystems, Inc., March 1998 (Operable Unit 1)

No. 336: *Toxicity Evaluation of Treated Effluent, July 1998 Samples*; prepared by EnviroSystems, Inc., July 1998 (Operable Unit 1)

No. 337: *Toxicity Evaluation of Treated Effluent, August 1998 Samples*; prepared by EnviroSystems, Inc., August 1998 (Operable Unit 1)

No. 342: *Toxicity Evaluation of Treated Effluent, November 1998 Samples*; prepared by EnviroSystems, Inc., November 1998 (Operable Unit 1)

No. 351: *Acute & Chronic Toxicity Test Report, March 99 Samples*; prepared by Severn Trent Laboratories, March 99 (Operable Unit 1)

No. 358: *Acute & Chronic Toxicity Test Report, June 1999 Samples;* prepared by Severn Trent Laboratories, July 1999 (Operable Unit 1)

No. 359: *Acute & Chronic Toxicity Test Report, September 1999 Samples;* prepared by Severn Trent Laboratories, September 1999 (Operable Unit 1)

No. 361: *Acute & Chronic Toxicity Test Report, December 1999 Samples*; prepared by Severn Trent Laboratories, December 1999 (Operable Unit 1)

No. 374: *Toxicity Evaluation of Treated Effluent, February 2000 Samples*; prepared by EnviroSystems, Inc., February 2000 (Operable Unit 1)

No. 377: *Toxicity Evaluation of Treated Effluent, May 2000 Samples*; prepared by EnviroSystems, Inc., May 2000 (Operable Unit 1)

No. 397: *Toxicity Evaluation of Treated Effluent, August 2000 Samples*; prepared by EnviroSystems, Inc., August 2000 (Operable Unit 1)

No. 401: *Toxicity Evaluation of Treated Effluent, December 2000 Samples*; prepared by EnviroSystems, Inc., December 2000 (Operable Unit 1)

No. 414: *Toxicity Evaluation of Treated Effluent, February 2001 Samples*; prepared by EnviroSystems, Inc., February 2001 (Operable Unit 1)

No. 425: *Toxicity Evaluation of Treated Effluent, May 2001 Samples*; prepared by EnviroSystems, Inc., May 2001 (Operable Unit 1)

No. 427: *Toxicity Evaluation of Treated Effluent, August 2001 Samples*; prepared by EnviroSystems, Inc., August 2001 (Operable Unit 1)

SECTION 8: POST RECORDS OF DECISION (RAP/IROD) (CONT.):

Operable Unit 1 Remedial Action – Operation (Toxicity Reports-Cont.)

No. 428: *Acute & Chronic Toxicity Test Report, August 2001 Samples*; prepared by Severn Trent Laboratories, August 2001 (Operable Unit 1)

No. 433: *Toxicity Evaluation of Treated Effluent, November 2001 Samples*; prepared by EnviroSystems, Inc., November 2001 (Operable Unit 1)

No. 443: *Acute & Chronic Toxicity Test Report, February 2002 Samples*; prepared by Severn Trent Laboratories, February 2002 (Operable Unit 1)

No. 451: *Acute & Chronic Toxicity Test Report, May 2002 Samples*; prepared by Severn Trent Laboratories, May 2002 (Operable Unit 1)

No. 458: *Acute & Chronic Toxicity Test Report, August 2002 Samples*; prepared by Severn Trent Laboratories, August 2002 (Operable Unit 1)

No. 459: *Acute & Chronic Toxicity Test Report, "Filtered" August 2002 Samples*; prepared by Severn Trent Laboratories, August 2002 (Operable Unit 1)

No. 467: *Acute & Chronic Toxicity Test Report, December 2002 Samples – Filtered & Un-filtered*; prepared by Severn Trent Laboratories, *December 2002* (Operable Unit 1)

No. 474: *Acute & Chronic Toxicity Test Report, March 2003 Samples – Filtered & Un-filtered*; prepared by Severn Trent Laboratories, *March 2003* (Operable Unit 1)

No. 479: *Acute & Chronic Toxicity Test Report, July 2003 Samples – Filtered & Un-filtered*; prepared by Severn Trent Laboratories, *July 2003* (Operable Unit 1)

No. 482: *Acute & Chronic Toxicity Test Report, December 2003 Samples*; prepared by Severn Trent Laboratories, *December 2003* (Operable Unit 1)

No. 499: *Acute & Chronic Toxicity Test Report, August 2004 Samples*; prepared by Severn Trent Laboratories, August 2004 (Operable Unit 1)

OU-1 Remedial Action – Operation (Monitoring)

No. 98: *Long Term Monitoring Report—Round 4*; prepared by Haley & Aldrich, Inc., November 1990 (Operable Unit 1)

No. 99: *Long Term Monitoring Report—Round 4 Quality Control Summary Report*; prepared by Haley & Aldrich, Inc., November 1990 (Operable Unit 1)

No. 100: *Long Term Monitoring Report—Round 5;* prepared by Haley & Aldrich, Inc., March 1991 (Operable Unit 1)

No. 101: *Long Term Monitoring Report—Round 5 Quality Control Summary Report*; prepared by Haley & Aldrich, Inc., March 1991 (Operable Unit 1)

No. 108: *Long Term Monitoring—Rounds 4, 5, & 6 Daily Quality Control Reports*; prepared by Haley & Aldrich, Inc., November 1990, March 1991 and August 1991 (Operable Unit 1)

No. 118: *Long Term Monitoring Report—Round 6*; prepared by Haley & Aldrich, Inc., February 1992 (Operable Unit 1)

No. 119: *Long Term Monitoring Report—Round 6 Quality Control Summary Report*; prepared by Haley & Aldrich, Inc., February 1992 (Operable Unit 1)

SECTION 8: POST RECORDS OF DECISION (RAP/IROD) (CONT.):

OU-1 Remedial Action – Operation (Monitoring-Cont.)

No. 189: *Long Term Monitoring Report—Round 6 Revised*; prepared by Haley & Aldrich, Inc., June 1994 (Operable Unit 1)

No. 221: *Long Term Monitoring Report—Round 7—Field Investigation Report*; prepared by Haley & Aldrich, Inc., June 1995 (Operable Unit 1)

No. 226: *Long Term Monitoring Report—Round 7—Quality Control Summary Report*; prepared by Haley & Aldrich, Inc., June 1995 (Operable Unit 1)

No. 237: *Long Term Monitoring Report—Round 7—Analytical Results Report*; prepared by Haley & Aldrich, Inc., June 1995 (Operable Unit 1)

No. 238: *Long Term Monitoring Report—Round 8—Field Investigation Report*; prepared by Haley & Aldrich, Inc., June 1995 (Operable Unit 1)

No. 239: *Long Term Monitoring Report—Round 8—Quality Control Summary Report*; prepared by Haley & Aldrich, Inc., June 1995 (Operable Unit 1)

No. 240: *Long Term Monitoring Report—Round 8—Analytical Results Report*; prepared by Haley & Aldrich, Inc., June 1995 (Operable Unit 1)

No. 272: *Long Term Monitoring Report—Round 9—Field Investigation Report (2 volumes)*; prepared by Haley & Aldrich, Inc., January 1997 (Operable Unit 1)

No. 283: *Long Term Monitoring Report—Round 9—Analytical Results Report*; prepared by Haley & Aldrich, Inc., January 1997 (Operable Unit 1)

No. 284: *Long Term Monitoring Report—Round 9—Quality Control Summary Report*; prepared by Haley & Aldrich, Inc., January 1997 (Operable Unit 1)

No. 295-A: *Long Term Monitoring Report—Round 10—Field Investigation Report*; prepared by Haley & Aldrich, Inc., August 1997 (Operable Unit 1)

No. 295-B: *Long Term Monitoring Report—Round 10—Analytical Results Report*; prepared by Haley & Aldrich, Inc., August 1997 (Operable Unit 1)

No. 296: *Long Term Monitoring Report—Round 10—Quality Control Summary Report*; prepared by Haley & Aldrich, Inc., August 1997 (Operable Unit 1)

No. 339: *Long Term Monitoring Report—Round 11—Analytical Results Report*; prepared by Haley & Aldrich, Inc., August 1998 (Operable Unit 1)

No. 340: *Long Term Monitoring Report—Round 11—Quality Control Summary Report*; prepared by Haley & Aldrich, Inc., August 1998 (Operable Unit 1)

No. 338: *Long Term Monitoring Report—Round 11—Field Investigation Report*; prepared by Haley & Aldrich, Inc., September 1998 (Operable Unit 1)

No. 369: *Analytical Data Package Report for Long Term Monitoring of Operable Unit 1*; prepared by IT Corporation, April 2000

SECTION 8: POST RECORDS OF DECISION (RAP/IROD) (CONT.):

OU-1 Remedial Action – Operation (Monitoring-Cont.)

No. 386: *Sampling of Volatile Organic Compounds in Groundwater by Diffusion Samplers and a Low-Flow Method, and Collection of Borehole-Flowmeter Data at Hanscom AFB*; prepared by USGS, 2000 (Received August 2000) (Operable Unit 1)

No. 391: *Analytical Data Package Report for Long Term Monitoring of Operable Unit 1 (April 2000 Samples)*; prepared by IT Corporation; August 2000

No. 394: *Analytical Data Package Report for Long Term Monitoring of Operable Unit 1 (June 2000 Samples);* prepared by IT Corporation; October 2000

No. 413: *Evaluation of a Diffusion Sampling Method for Determining Concentrations of Volatile Organic Compounds in Groundwater, Hanscom Air Force Base, Massachusetts;* prepared by USGS; 2000 (Operable Unit 1)

No. 400: *Analytical Data Package Report for Long Term Monitoring of Operable Unit 1 (September 2000 Samples)*; prepared by IT Corporation; January 2001

No. 402: *Analytical Data Package Report for Long Term Monitoring of Operable Unit 1 (November 2000 Samples)*; prepared by IT Corporation; March 2001

No. 411-1: *Analytical Data Package Report for Long Term Monitoring of Operable Unit 1 (January 2001 Samples)*; prepared by IT Corporation; April 2001

No. 411-2: *Data Validation Report for OU-1 Groundwater Samples (January 2001 Samples)*; prepared by Meridian Science & Technology; March 2001

No. 424: *Memorandum - Long-Term Monitoring of OU-1 (GC Analysis of May 2001 Samples);* prepared by Hanscom AFB Environmental Flight, July 2001

No. 440-1: *Final Analytical Data Package Report for Long Term Monitoring of Operable Unit 1 (September/November 2001 Samples)*; prepared by IT Corporation; March 2002

No. 440-2: *Data Validation Report for OU-1 Groundwater Samples (September 2001 Samples)*; prepared by Meridian Science & Technology; February 2002

No. 440-3: *Data Validation Report for OU-1 Groundwater Samples (November 2001 Samples)*; prepared by Meridian Science & Technology; February 2002

No. 449-1: *Final - Analytical Data Package Report for Long Term Monitoring of Operable Unit 1 (April 2002/Site 3 Samples)*; prepared by IT Corporation; August 2002

No. 449-2: *Data Validation Report for OU-1 Groundwater Samples (April 2002/Site 3 Samples)*; prepared by Environmental Data Services; June 2002

No. 454: *Analytical Data Reports for 1997 through 1998 OU-1 Samples collected by Arcadis Geraghty & Miller in association with VER Demonstration at Site1;* collated by Hanscom AFB Environmental Flight, 1998

No. 455: *Analytical Data Reports issued by US EPA Lab for 1999 OU-1 Samples collected by USGS for Diffusion Sampler Demonstration;* collated by Hanscom AFB Environmental Flight, 1999

No. 456: *Memorandum - Long-Term Monitoring of OU-1 (GC Analysis of May 2002 Samples);* prepared by Hanscom AFB Environmental Flight, June 2002

SECTION 8: POST RECORDS OF DECISION (RAP/IROD) (CONT.):

OU-1 Remedial Action – Operation (Monitoring-Cont.)

No. 461-1: *Analytical Data Package Report for Long Term Monitoring of Operable Unit 1 (September 2002 Samples)*; prepared by IT Corporation; January 2003

No. 461-2: *Data Validation Report for OU-1 Groundwater Samples (September 2002 Samples)*; prepared by Environmental Data Services; November 2002

No. 419: *Final - Basewide Quality Assurance Project Plan (QAPP) with Amendment 1 for LTM at OU1, OU3/Sites 6 & 21, IRP Sites 13 & 22, and the FAFSUST Site* - 2 Volumes; prepared by IT Corporation, Revised January 2003

No. 472-1: *Analytical Data Package Report for Long Term Monitoring of Operable Unit 1 (November and December 2002 Samples)*; prepared by Shaw Environmental, Inc.; May 2003

No. 472-2: *Data Validation Report for OU-1 Groundwater Samples collected in November and December 2002*; prepared by Environmental Data Services; November 2002

No. 472-3: *Analytical Data Report for Long Term Monitoring of Operable Unit 1 (November 2002 Samples for MNA Assessment)*; prepared Obrien & Gere; November 2002

No. 488-1: *Groundwater Monitoring Report for Long Term Monitoring of Operable Unit 1 (November 2003 Samples)*; prepared by Shaw Environmental, Inc.; January 2004

No. 488-2: *Laboratory Report for November 2003 Samples*; prepared Obrien & Gere; November 2003

No. 488-3: *Analytical Data Report for November 2003 Samples for the MNA Assessment of NPL OU-1*; prepared Obrien & Gere; November 2003

No. 488-4: *Data Validation Report for OU-1 Groundwater Samples collected in November 2003*; prepared by Environmental Data Services; January 2004

No. 498: *Memorandum - Long-Term Monitoring of OU-1 (GC Analysis of May 2003 Samples);* prepared by 66MSG/CEGV, Hanscom AFB, August 2003

No. 505-1: *Long Term Monitoring Report for Operable Unit 1 (November 2004 Samples)*; prepared by Shaw Environmental, Inc.; January 2004

No. 505-2: *Laboratory Report for November 2004 Samples*; prepared Obrien & Gere; December 2004

No. 505-3: *Data Validation Report for OU-1 Groundwater Samples collected in November 2004*; prepared by Environmental Data Services; January 2005

No. 518-1: *Long Term Monitoring Report for Operable Unit 1 (November 2005 Samples)*; prepared by Shaw Environmental, Inc.; March 2006

No. 518-2: *Laboratory Report for November 2005 Samples*; prepared Life Sciences; December 2005

No. 518-3: *Data Validation Report for OU-1 Groundwater Samples collected in November 2005*; prepared by Environmental Data Services; January 2006

No. 526: *Basewide Quality Assurance Project Plan (QAPP) for LTM at NPL OU1, NPLOU3/Site 6, NPL OU3/Site 21, and MCP Sites (IRP Sites 13 & 22, and the FAFSUST Site)* - 2 Volumes; prepared by MaraTech Engineering Services, July 2004

SECTION 8: POST RECORDS OF DECISION (RAP/IROD) (CONT.):

OU-1 Remedial Action – Operation (Monitoring-Cont.)

No. 530-1: *Long Term Monitoring Report for Operable Unit 1 (November 2006 Samples)*; prepared by Shaw Environmental, Inc.; May 2007

No. 530-2: *Laboratory Report for November 2006 Samples*; prepared Life Sciences; December 2006

No. 530-3: *Data Validation Report for OU-1 Groundwater Samples collected in November 2006*; prepared by Environmental Data Services; April 2007

SECTION 9: COMMUNITY RELATIONS

CORRESPONDENCE FOLDERS

DOCUMENTS:

No. 197: *Restoration Advisory Board (RAB) Minutes*, prepared by Hanscom AFB, 29 Nov 94 to present

No. 275-1: *Restoration Advisory Board Meeting Presentation—Groundwater Monitoring Round 8;* prepared by Haley & Aldrich, Inc., September 1995 (Operable Unit 1)

No. 263: *Restoration Advisory Board 14 May 1996 Presentation Materials;* prepared by CH2M Hill, May 1996.

No. 275-2: *Restoration Advisory Board Meeting Presentation—Groundwater Monitoring Round 9;* prepared by Haley & Aldrich, November 1996 (Operable Unit 1)

No. 355: *Community Relations Plan for CERCLA (Superfund) Remedial Response Actions and Removal Actions;* prepared by Hanscom AFB; April 1999

No. 382: *NPL Operable Unit 1 Interim Proposed Plan—Information Meeting and Public Hearing Briefing Slides;* prepared by Hanscom AFB, 28 June 2000

No. 538: *NPL Operable Unit 1 Proposed Plan—Information Meeting and Public Hearing Briefing Slides;* prepared by Shaw Environmental, Inc., 20 June 2007

SECTION 10: OTHER IRP ADMINISTRATIVE RECORD RELATED DOCUMENTS:

CORRESPONDENCE FOLDERS

DOCUMENTS:

No. 270: *Report on Development of Groundwater Supplies;* prepared by Metcalf & Eddy; July 1960 (Basewide).

No. 144: *40 CFR Part 300 Hazard Ranking System, Final Rule;* published by US Government, December 1990

No. 257-1: *Base Comprehensive Plan, Vol. I and II;* prepared by Benham GP, September 1991

No. 257-2: *General Plan, Hanscom Air Force Base;* prepared by Michael Baker Jr., Inc. & Applied Geographics Inc., October 1998. (replaces 257-1)

No. 257-3: *General Plan Update, Hanscom Air Force Base;* prepared by Parsons Brinckerhoff Quade & Douglas, Inc., November 2003

SECTION 10: OTHER IRP ADMINISTRATIVE RECORD RELATED DOCUMENTS:

DOCUMENTS:

No. 131-A: *Management Action Plan (MAP) Guidebook;* published by Department of the Air Force, May 1992

No. 131-B: *Management Action Plan (MAP) Guidebook Update;* published by Department of the Air Force, December 1999

No. 148: *Hanscom AFB's Initial Management Action Plan (MAP);* prepared by Radian Corporation; December 1992

No. 222: *Management Action Plan (MAP)—Fiscal Year 1993;* prepared by Hanscom AFB; December 1992

No. 223: *Management Action Plan (MAP)—Fiscal Year 1994;* prepared by Hanscom AFB; December 1993

No. 170: *CERCLA/IRP Legal review Guide;* published by Air Force Materiel Command, 1993

No. 155: *U.S. Air Force Environmental Restoration Program NFRAP Guide;* prepared by Department of the Air Force, June 1995

No. 224: *Management Action Plan (MAP)—Fiscal Year 1995;* prepared by Hanscom AFB; January 1995

No. 356: *Management Action Plan (MAP)—Fiscal Year 1999;* prepared by Hanscom AFB, April 1999

No. 125: *U.S. Air Force Restoration Program Remedial Project Manager's Handbook;* prepared by HQ USAF/ILEVR, revised 2000

No. 447: *Management Action Plan (MAP);* prepared by Hanscom AFB, Revised 15 February 2002

No. 466: *Guide for Addressing Natural Resource Injury; Department of the Air Force*, July 2002

No. 490-1: *Public Comment Document – Public Health Assessment for Hanscom Field/Hanscom AFB; Prepared* by ATSDR, February 2004

No. 490-2: *Final Public Health Assessment for Hanscom Field/Hanscom AFB; Prepared* by ATSDR, April 2004

APPENDIX
B

Appendix B – Transcript of the Hearing on June 20, 2007 concerning the Proposed Plan for NPL OU-1

ORIGINAL

VOLUME I
PAGES: 1 7

COMMONWEALTH OF MASSACHUSETTS

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IN RE:
CLEAN-UP PLAN AT
HANSCOM AIR FORCE BASE

* * * * * * * * * * * * *

Public Hearing
Town Hall
10 Mudge Way
Bedford, MA 01730
8:06 p.m.

P R O C E E D I N G S

MR. MORRIS: I see it's now a little bit after eight o'clock and we will now begin the public hearing for the Record of Decision. I'll turn the public hearing over to Mike and let him do the presentation.

MR. QUINLAN: We are now starting the public hearing portion of the meeting. The official record is now open. My name is Michael Quinlan and I will be the hearing officer for tonight. The purpose of the hearing is to accept oral comments, testimony and written comments on the Proposed Plan for the area on Hanscom Field identified as Operable Unit 1, which includes Installation Restoration Program Sites 1, 2 and 3.

All comments and testimony that are given tonight will be transcribed verbatim and become part of the official record on this project. Each and every comment will be responded to and the Responsiveness Summary that will be issued after the close of the public comment period. The

Responsiveness Summary will be attached to the Record of Decision. The Record of Decision will contain the Air Force's selected alternative for Operable Unit 1 and rationale for the selection.

This hearing is different than the informational hearing held earlier. It is exclusively for listening to and recording your oral comments. We will not respond to your comments during the hearing unless you need clarification on something. We may ask you for clarification if we are not sure what your comment is. Everyone wanting to comment will be given the opportunity to do so. Please speak up so that everyone present can hear. If you want a copy of the Responsiveness Summary mailed to you when it is issued, please state your name and mailing address. If you do not want a copy of the Responsiveness Summary, just state your name and town of residence.

The floor is now open to comment on the Proposed Plan for Hanscom Air Force Base's Operable Unit 1.

(No comments.)

MR. QUINLAN: Are there any further comments to be offered for the Proposed Plan for Hanscom Air Force Base's Operable Unit 1? If there are no further comments to be made, then I should now close the official record for oral testimony.

AUDIENCE MEMBER: I'm Mark Pearson, Bedford resident. On the information I have heard in the previous session, I think we should approve the plan. We should go forward as presented to the RAB meeting and to continue the progress of water treatment and operating Unit 1 and monitoring.

AUDIENCE MEMBER: I'm Gary Waldeck with Mass. DEP. We'll provide comments by the end of public comment period.

MR. QUINLAN: Are there any further comments to be offered for the Proposed Plan for Hanscom Air Force Base's Operable Unit 1?

AUDIENCE MEMBER: Yes. I'm Sid Krismsky. I work at Hanscom Air Force Base. Is there any risk that funding will be

decreased or at least cut back to where you could not implement G-3?

MR. MORRIS: I'm Don Morris of the Air Force and I'll try to answer that.

Based upon the 20-year funding of this program where every -- every one of those 20 years we've been fully funded. So based on that record it's - we're confident that the funding levels that we need should be available, especially when you look at the big picture, but, of course, it's always subject to the approval of you folks. But we have been fully funded for the last -- since Day 1.

Does that answer your question, sir?

AUDIENCE MEMBER: Yes.

MR. QUINLAN: There are any further comments to be offered for the Proposed Plan for the Hanscom Air Force Base Operable Unit 1?

(No comments.)

If there are no further comments to be made, then I shall now close the official record for oral testimony.

The record is now closed. Please note that you can still provide written comments through July 9, 2007. I thank you all for coming and have a good evening.

(Whereupon the hearing concluded at 8:16 p.m.)

C E R T I F I C A T E

COMMONWEALTH OF MASSACHUSETTS

MIDDLESEX, SS.

I, Karen Borreson, Notary Public, do hereby certify that the foregoing record, pages 1 through 6, is a complete, accurate, and true transcription of the matter taken in the aforementioned matter to the best of my knowledge, skills, and ability.

Karen Borreson

My Commission Expires: 5/21/10

APPENDIX
C

Appendix C - Cost Table

COST ESTIMATE FOR ALTERNATIVE G-3
EXISTING DYNAMIC GROUNDWATER REMEDIATION SYSTEM, LAND USE CONTROLS and MONITORING
NPL OU-1
HANSCOM AIR FORCE BASE

Operation and Maintenance (O&M) & Long-Term Monitoring (LTM) Costs

ITEM DESCRIPTION (Annual Activities)	UNITS	QUANTITY	UNIT COST	TOTAL COST (&)
1.0 System O&M - Includes Monthly RA Report	month	12	$ 24,000	$ 288,000
Compliance Monitoring via EPA 601 - Influent & Effluent Monthly	each	20	$ 70	$ 1,400
except via EPA 624 Semi-annually	each	4	$ 130	$ 520
VER System Compliance Monitoring via Microseeps - 3/mo	each	36	$ 110	$ 3,960
VER Carbon Replacement/Disposal (1,200 lb GAC Unit)	each	4	$ 2,500	$ 10,000
2.0 Sludge Disposal	LS	1	$ 1,000	$ 1,000
3.0 Major Repair and/or alterations	LS	1	$ 12,000	$ 12,000
4.0 Annual LTM S&A (per round)				
Field Crew - in-house staff	na	na	na	$ -
Laboratory Analysis (VOCs via EPA 8260A)	each	47	$ 130	$ 6,110
PE Sample (VOCs)	each	1	$ 150	$ 150
Fedex	cooler	3	$ 100	$ 300
5.0 Data Validation - Laboratory Analytical Report	each	47	$ 20	$ 940
6.0 Annual Groundwater Report	LS	1	$ 10,000	$ 10,000
Subtotal				$ 334,380
7.0 Project Manaagement - 10%				$ 33,438
Subtotal				$ 367,818
8.0 Contractor G&A (6%)				$ 22,069
Subtotal				$ 389,887
9.0 Contractor Profit (6%)				$ 23,393
10.0 Contractor Total				$ 413,280
11.0 GF Electricity - Annually	LS	1	$ 66,000	$ 66,000
12.0 GF Propane	gallon	25,000	$ 1.60	$ 40,000
Total Annual Cost - Year 1				$ 519,280
Government Costs to include establishing/maintaing, monitoring and enforcing LUCs/Ics				$ 25,964
Year 1 Total				**$ 545,244**
Total Annual Cost (Year 2-30)				$ 519,280
Years 2-30 - Government Costs to include establishing/maintaing, monitoring and enforcing LUCs/ICs				$ 25,964
Year 2-30 Subtotal				$ 545,244
Present Worth Annual O&M and LTM (30-yrs, I=7%)				**$ 6,694,332**
Total Present Worth - O&M and LTM Year 1 + Years 2-30				**$ 7,239,576**

5 Year Site Reviews

ITEM DESCRIPTION (Annual Activities)	UNITS	QUANTITY	UNIT COST ($)	TOTAL COST (&)
13.0 5 Year Site Review	Lump sum	1	20000	20000
Total Cost of Review				$ 20,000
Contingency (25%)				$ 5,000
Subtotal/per review				$ 25,000
Present value of series of 6 intervals of 5 years (30yr, I=7%)				$ 53,945
Total Present Worth - 5-Year Reviews through year 30				**$ 53,945**
TOTAL PRESENT WORTH COST (from above)				**$ 7,293,522**

Comments

System O&M does not includes acid wash/clean and repack of air stripping towers or the replacement/disposal of the 5,000 lb GAC units.
System O&M and Project Management includes the Contractor's support in establishing/maintaing, monitoring and enforcing LUCs/Ics.
Re: 4.0, 5.0 & 6.0 - Alternative G-3 Groundwater Monitoring Assumptions:
33 wells and 1 surface water points sampled annually
QA/QC samples (DUP/MS/MSD) collected at a 10% frequency (i.e. 1 QA/QC set of samples per 10 regular samples)
3 trip blanks submitted annually

APPENDIX
D

Appendix D – ARAR Tables

Media	Requirement	Requirement Synopsis	Action to be Taken to Attain Requirement	Status
Chemical Specific ARARs				
Groundwater	*Federal*			
	Federal Safe Drinking Water Act Maximum Contaminant Levels (MCLs) (40 CFR 141.11-141.16)	MCLs are enforceable standards that regulate the concentration of specific organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water supplies. They also may be considered relevant and appropriate for groundwater aquifers potentially used for drinking water. Primary threat COCs in groundwater are VOCs.	Alternative G-3's groundwater remediation system will treat extracted groundwater to attain MCLs before discharging the treated groundwater to the recharge basins and/or drainage ditch. The standards will not be attained in groundwater at the source ares or within the contaminated plumes in the short-term, however, all RAOs are expected to be achieved in a reasonable (<50-years) period of time. In the interim LUCs will serve to control the potential access and exposure to contaminated media within the OU-1.The selected remedy also includes annual groundwater and surface water monitoring in order to track changes in contaminant concentrations over time. MCLs are listed in Table 2-1 for compounds of concern at OU-1.	Relevant and Appropriate
	Federal Safe Drinking Water Act Maximum Contaminant Level Goals (MCLGs) (40 CFR 141.50-141.51)	Non-zero MCLGs are nonenforceable health goals for public water systems. MCLGs are set at levels that would result in no known or expected adverse health effects with an adequate margin of safety. Non-zero MCLGs are to be used as goals when MCLs have not been established for a particular compound of concern.	Alternative G-3's groundwater remediation system will treat extracted groundwater to attain MCLs before discharging the treated groundwater to the recharge basins and/or drainage ditch. The standards will not be attained in groundwater at the source ares or within the contaminated plumes in the short-term, however, all RAOs are expected to be achieved in a reasonable (<50-years) period of time. In the interim LUCs will serve to control the potential access and exposure to contaminated media within the OU-1.The selected remedy also includes annual groundwater and surface water monitoring in order to track changes in contaminant concentrations over time. MCLs are listed in Table 2-1 for compounds of concern at OU-1.	Relevant and Appropriate
	USEPA Risk Reference Doses (RfDs)	RfDs are considered the levels unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure for a lifetime.	USEPA RfDs will be used to calculate risk-based groundwater cleanup levels for non-carcinogens when no federal or state MCL or non-zero MCLG or state GWQS is available.	To Be Considered
	USEPA Carcinogen Assessment Group Cancer Slope Factors (CSFs)	CSFs represent the most-up-to-date information on cancer risk from USEPA Carcinogen Assessment Group.	USEPA RCSFs will be used to calculate risk-based groundwater cleanup levels for non-carcinogens when no federal or state MCL or non-zero MCLG or state GWQS is available.	To Be Considered
	USEPA Guidelines for Carcinogen Risk Assessment	These guidelines provide a framework for assessing cancer risks from exposure to pollutants or other agents in the environment	USEPA Guidelines will be used to assess risk posed by the site contaminants.	To Be Considered
	USEPA Supplemental Guidance for Assessing Susceptibility from Early Life Exposure to Carcinogens	These guidelines provide a framework for assessing cancer risks from exposure to pollutants or other agents in the environment	USEPA Guidelines will be used to assess risk posed by the site contaminants.	To Be Considered
	State			
	Massachusetts Drinking Water Standards (310 CMR 22.00)	These standards establish State MCLs for organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water systems. They are to be used where they are more stringent than Federal MCLs.	Alternative G-3's groundwater remediation system will treat extracted groundwater to attain MCLs before discharging the treated groundwater to the recharge basins and/or drainage ditch. The standards will not be attained at the source ares or within the contaminated plumes in the short-term, however, all RAOs are expected to be achieved in a reasonable (<50-years) period of time. In the interim LUCs will serve to control the potential access and exposure to contaminated media within the OU-1.The selected remedy also includes annual groundwater and surface water monitoring in order to track changes in contaminant concentrations over time. MCLs are listed in Table 2-1 for compounds of concern at OU-1.	Relevant and Appropriate
	Massachusetts Contingency Plan (MCP) Method 1 GW-1 and GW-2 Standards (310 CMR 40.0974)	These are promulgated standards for characterizing the risk posed by COCs in groundwater under the MCP. The MCP Method 1 GW-1 and GW-2 standards will only apply for compounds where the standard is more restrictive than the federal MCL or MCLG, or for which no MCL or MCLG currently exists. Primary threat COCs in groundwater are VOCs.	Alternative G-3's groundwater remediation system will treat extracted groundwater to attain MCLs before discharging the treated groundwater to the recharge basins and/or drainage ditch. The standards will not be attained in groundwater at the source ares or within the contaminated plumes in the short-term, however, all RAOs are expected to be achieved in a reasonable (<50-years) period of time. In the interim LUCs will serve to control the potential access and exposure to contaminated media within the OU-1.The selected remedy also includes annual groundwater and surface water monitoring in order to track changes in contaminant concentrations over time. MCLs are listed in Table 2-1 for compounds of concern at OU-1.	Relevant and Appropriate

APPENDIX D - ARARs Table Hanscom AFB OU-1 - Selected Remedy (Alternative G-3) - *Existing Dynamic Groundwater Remediation System, Land Use Controls and Monitoring*

Media	Requirement	Requirement Synopsis	Action to be Taken to Attain Requirement	Status
	Massachusetts Groundwater Quality Standards (314 CMR 6.00)	These standards limit the concentration of certain materials allowed in classified Massachusetts water. The groundwater at the site has been designated as GW-1 (i.e., as a potential future drinking water supply) under state law by means of a Town of Bedford Aquifer Protection District by-law that was enacted through a process authorized by and implementing the MCP. In addition, MADEP has classified the eastern side of OU-1, east of Runway 5-23, as an approved Zone II; under the state drinking water regulations (310 CMR 22.02), a Zone II is "that area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated." Further in addition, the northeastern portion of the site at the northern end of Runway 5-23 is classified as a Potentially Productive Aquifer; the MCP defines "Potentially Productive Aquifer" in part as "all aquifers delineated by the U.S. Geological Survey (USGS) as a high or medium yield aquifer."	Alternative G-3's groundwater remediation system will treat extracted groundwater to attain GW-1 standards unless a more restrictive state standard has been promulagated in which case the more stringent state standard will be met. GW-1 standards will not be attained in groundwater at the source ares or within the contaminated plumes in the short-term, however, all RAOs are expected to be achieved in a reasonable (<50-years) period of time. In the interim LUCs will serve to control the potential access and exposure to contaminated media within the OU-1.The selected remedy also includes annual groundwater and surface water monitoring in order to track changes in contaminant concentrations over time. GW-1 standards are listed in Table 2-1 for compounds of concern at OU-1.	Applicable
Location Specific ARARs				
Surface water and wetlands	***Federal***			
	Fish and Wildlife Coordination Act (16 USC 661 et seq.)	This act requires consultation with the Fish and Wildlife Service and the state wildlife resource agency if alteration of a body of water, including discharge of pollutants into a wetland, will occur as a result of off-site remedial activities. Consultation is strongly recommended for on-site actions. This provides protection for actions that would affect streams, wetlands, other water bodies or protected habitats. Any action taken should protect fish or wildlife, and include measures developed to prevent, mitigate, or compensate for project-related losses to fish and wildlife.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system which discharges treated groundwation into a drainage ditch which emptys into in the Wetland B/Beaver Pond Area surface water. The selected remedy includes monitoring of the treatment system effluent and the long-term monitoring of groundwater and surface water. Precautions will be taken to minimize the potential effect on fish and wildlife during these activities and any future remediation system alterations.	Relevant and Appropriate
Wetland sediment and surface water	***Federal***			
	Protection of Wetlands - Executive Order 11990 (40 CFR 6, Appendix A)	Appendix A of 40 CFR 6 sets forth policy for carrying out provisions of the Protection of Wetlands Executive Order. Under this order, federal agencies are required to minimize the degradation, loss, or destruction of wetlands, and to preserve the natural and beneficial values of wetlands. Appendix A requires that no remedial alternatives adversely affect a wetland if another practicable alternative is available. If no alternative is available, effects from implementing the chosen alternative must be mitigated.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system and the long-term monitoring of groundwater and surface water. No additional actions, other than monitoring, are proposed in the wetlands until RAOs are achieved and existing wells in the Wetland B/Beaver Pond Area are decommissioned. There is no practicable alternative these remedy components located in or near the Wetland B/Beaver Pond Area. Precautions will be taken to minimize the potential effect on wetlands during these activities.	Applicable
	State			
	Massachusetts Wetlands Regulations (310 CMR 10.51-10.60, MGL c. 131, Section 40: Wetlands Protection Act)	These regulations protect inland wetlands such as those found at the site from activities that may alter the resource area by establishing buffer zone areas. The loss may be permitted with replication of the lost area within two growing seasons.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system and the long-term monitoring of groundwater and surface water. No additional actions, other than monitoring, are proposed in the wetlands until RAOs are achieved and existing wells in the Wetland B/Beaver Pond Area are decommissioned. There is no practicable alternative these remedy components located in or near to the Wetland B/Beaver Pond Area. Activities at the site will be performed in compliance with the buffer zone requirements for these resource areas. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	Applicable
Other Natural Resources	***Federal***			
	Protection of Floodplains, Executive Order 11988 (40 CFR 6, Appendix A)	Appendix A of 40 CFR 6 sets forth policy for carrying out provisions of the Protection of Floodplains Executive Order. Under this order, federal agencies are required to avoid adverse effects, minimize potential harm, and restore and preserve natural and beneficial values of the floodplain.	According to the Comprehensive Ecological Analysis (LEC, August 1997), portions of OU-1 are located within a 100-year floodplain. Alternative G-3 includes continued operation and optimization of the existing groundwater remediation system, and the long-term monitoring of groundwater and surface water. No practicable alternative to these remedy components exists. The floodplain storage capacity and hydraulics will not be changed by this remedy.	Applicable

Media	Requirement	Requirement Synopsis	Action to be Taken to Attain Requirement	Status
Action Specific ARARs				
Surface water	*Federal*			
	Clean Water Act National Pollutant Discharge Elimination System (NPDES) Regulations (40 CFR 122-125 and 131)	These regulations establish discharge limitations, monitoring requirements and best management practices for any direct discharge from a point source into surface water.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system, which includes the discharge of effluent from the treatment plant to a drainage channel which emptys into in the Wetland B/Beaver Pond Area surface water.. The effluent will be sampled and analyzed to ensure compliance with regulatory discharge parameters.	Applicable
	State			
	Clean Waters Act - Surface Water Discharge Permit Program (314 CMR 3.00; MGL c. 21 Sections 26-53)	This act and program establish the requirements intended to maintain the quality of surface waters by controlling the direct discharge of pollutants to surface waters. Direct discharges of wastewater to surface waters must meet effluent discharge limits established by this program.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system, which includes the discharge of effluent from the treatment plant to a drainage channel which emptys into in the Wetland B/Beaver Pond Area surface water.. The effluent will be sampled and analyzed to ensure compliance with regulatory discharge parameters. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	Applicable
Groundwater	*Federal*			
	Resource Conservation and Recovery Act (RCRA) 40 CFR Part 264, Subpart F-Releases from Solid Waste Management Units (40 CFR 264.90-264.101 and 265.90-265.94)	General facilities requirements for groundwater monitoring at affected facilities and general requirements for corrective action programs, if required, at the affected facilities.	This program has been delegated to the state. Groundwater monitoring will be conducted in accordance with Massachusetts requirements.	Applicable
	Underground Injection Control Program (UIC) (40 CFR 141 148)	These regulations outline minimum program and performance standards for underground injection wells and prohibit any injection that may cause a violation of any primary drinking water regulation in the aquifer.	This program has been delegated to the state and takes effect through the State requirements listed below.	Applicable
	State			
	MA Hazardous Waste Management Rules (HWMR) Groundwater Protection (310 CMR 30.660-30.679)	These regulations require groundwater monitoring at specified regulated units that treat, store or dipose of hazardous waste. Maximum concentration limits for the hazardous constituents are specified in 310 CMR 30.668.	Groundwater monitoring under Alternative G-3 will be conducted in accordance with these requirements.	Applicable
	MA Standards for Analytical Data for Remedial Response Action, Bureau of Waste Site Cleanup Policy 300-89.	This policy decribes the minimum standards for analytical data submitted to the MADEP.	All sampling plans for Alternative G-3 will be designed with consideration of the analytical methods provided in this policy.	To Be Considered
	Massachusetts Groundwater Discharge Permit Program (314 CMR 5.00; MGL c.21 Sections 26-53; 310 CMR 27.01 - 27.11)	This program is designed to protect state groundwaters for their highest potential use by regulating discharges of pollutants to state groundwaters and requiring the MADEP to regulate the outlets for groundwater discharges and associated treatment works. These regulations set effluent limits for the discharge of pollutants to groundwater. Recharge wells used exclusively to replenish an aquifer with uncontaminated water are exempt from this requirement. Uncontaminated water is water which upon discharge could not cause a violation of applicable water quality standards.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system, which includes the option to discharge of treated water to the ground via recharge basins. The treatment system's effluent will be sampled and analyzed to ensure the discharge of treated water to groundwater would comply with the substantive requirements of these regulations. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	Applicable
	MA Underground Injection Control (UIC) Program (310 CMR 23.01-23.11)	These regulations require acquiring a permit in order to inject wastes, chemicals or other substances into the subsurface.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system, which may include the injection of permanganate, molasses or other substances for in-situ remediation of on-site groundwater contaminants. To ensure that these injections complies with the substantive requirements of these regulations the proposed quantities to be injected will be included in the work plan/design that will be submitted to EPA and MA DEP for comment and concurrence prior to an injection and injections will only be considered for on-site locations that are upgradient of the boundary interceptor wells. Also the groundwater monitoring program will reviewed/revised to ensure adequacy for the assessment of the impact of any injections. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	Applicable

APPENDIX D - ARARs Table Hanscom AFB OU-1 - Selected Remedy (Alternative G-3) - *Existing Dynamic Groundwater Remediation System, Land Use Controls and Monitoring*

Media	Requirement	Requirement Synopsis	Action to be Taken to Attain Requirement	Status
Miscellaneous Actions	*State*			
	Massachusetts Erosion and Sediment Control Guidelines for Urban and Suburban Areas (May 2003)	Provides guidance and best management practices regarding erosion and sediment control.	Construction of any new wells (if needed) will be performed in accordance with *this guidance as appropriate.*	To Be Considered
	Massachusetts Well Decommissioning Requirements (313 CMR 3.03)	These regulations provide for certain notification requirements upon well abandonment.	The decommissioning or abandonment of wells (when no longer needed) will be performed in accordance with these requirements.	Applicable
Waste	*Federal*			
	RCRA Identification and Listing of Hazardous Wastes (40 CFR 261.24)	These requirements establish the maximum concentrations of contaminants for which the waste would be a RCRA-characteristic hazardous waste for toxicity.	Alternative G-3 ncludes continued operation and optimization of the groundwater remediation system, which includes the potential generation of wastes which may be classified as hazardous. These materials include the recovered solvent from the groundwater treatment system, the activated carbon from the air/vapor treatments systems associated with the groundwater treatment and vacuum enhanced recovery systems, groundwater samples, and soil borings that may result from the installation of new wells. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	Applicable
	RCRA Standards Applicable to Generators of Hazardous Waste (40 CFR Part 262)	Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations.	Alternative G-3 ncludes continued operation and optimization of the groundwater remediation system, which includes the potential generation of wastes which may be classified as hazardous. These materials include the recovered solvent from the groundwater treatment system, the activated carbon from the air/vapor treatments systems associated with the groundwater treatment and vacuum enhanced recovery systems, groundwater samples, and soil borings that may result from the installation of new wells. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	Applicable
	State			
	MA HWMR, Use and Management of Containers, 310 CMR 30.689; Storage and Treatment in Tanks, 310 CMR 30.699	These regulations set forth requirements for use and management of containers and tanks at hazardous waste facilities.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system, which includes the potential generation of wastes which may be classified as hazardous. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	Applicable
	Massachusetts Hazardous Waste Management Rules (HWMR), 310 CMR 30.300-30.371, Requirements for Generators	Establishes requirements and standards for generators of hazardous waste that address general waste management measures, including the accumulation of hazardous waste prior to off-site disposal, preparing the hazardous wastes for shipment, and preparing appropriate waste manifests.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system, which includes the potential generation of wastes which may be classified as hazardous. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	Applicable
Air	*Federal*			
	RCRA - Air Emission Standards for Process Vents, 40 CFR Part 264, Subpart AA	These regulations establish requirements for controlling emmisions from process vents associated with treatment processes that manage hazardous wastes with organic concentrations of 10 ppm or more.	If operation of the groundwater remediation system under Alternative G-3 involves management of hazardous waste with organic concentrations of at least 10 ppm, equipment used in remedial activies will meet the requirements and be monitored for compliance.	Relevant and Appropriate
	RCRA, Air Emission Standards for Equipment Leaks 40 CFR 264, Subpart BB	Contains air pollutant emission standards for equipment leaks at hazardous waste TSD facilities. Contains design specifications and requirements for monitoring for leak detection. It is applicable to equipment that contains or contacts hazardous wastes with organic concentrations of at least 10% by weight.	If operation of the groundwater remediation system under Alternative G-3 involves management of hazardous waste with organics of at least 10 ppm, equipment will meet the design specifications, and will be monitored for leaks.	Relevant and Appropriate

Media	Requirement	Requirement Synopsis	Action to be Taken to Attain Requirement	Status
	RCRA, Air Emission Standards for Tanks, Surface Impoundments and Containers (40 CFR 264, Subpart CC	Contains air pollutant emission standards for owners and operators of TSD facilities using tanks, surface impoundments, and containers to manage hazardous waste. Specific organic emissions controls have to be installed if the average volatile organic concentantions are equal or greater than 100 ppmw.	If operation of the groundwater remediation system under Alternative G-3 involves management of hazardous waste with organics of at least 10 ppm, equipment used in in remediation activities will meet the requirement to be monitored for compliance.	Relevant and Appropriate
	USEPA Policy on Control of Air Emissions from Superfund Air Strippers at Superfund Groundwater Sites, Office of Solid Waste and Emergency Response (OSWER) *Directive* 9355.0-28	Provides guidance on the control of air emissions from air strippers used at Superfund sites and distinguishes between requirements for attainment and nonattainment areas for ozone.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system, which includes an off-gas treatment system for the air strippers. This off-gas treatment system will be monitored and maintained to ensure air emissions meet discharge standards.	To Be Considered
	USEPA New England Region Memorandum, 12 July 1989 from Louis Gitto to Merril S. Hohman	States that Superfund air strippers in ozone nonattainment areas generally merit controls on all VOC emissions.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system, which already includes an off-gas treatment system for the air strippers.	To Be Considered
	State			
	MADEP Off-Gas Treatment of Point Source Remedial Air Emissions (Policy No. WSC-94-150)	This policy establishes permitting requirements for air stripper installations.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system, which already includes off-gas treatment systems for the air strippers and the vacuum enhanced recovery system that were designed to meet air discharge standards. These off-gas treatment systems are/will be monitored and maintained to ensure air emissions continue meet discharge standards. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	To Be Considered
	Massachusetts Air Pollution Control Regulations (310 CMR 7.18)	These regulations establish the standards and requirements for air pollution control in the Commonwealth. Section 7.18 details requirements for air pollution controls for volatile organic compounds.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system, which already includes off-gas treatment systems for the air strippers and the vacuum enhanced recovery system that were designed to meet air discharge standards. These off-gas treatment systems are/will be monitored and maintained to ensure air emissions continue meet discharge standards. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	Applicable
	Massachusetts Rules for Remedial Air Emissions (310 CMR 40.0049)	The Massachusetts rules set forth standards for emissions from remedial activities, including a general requirement for 95% control over emissions from the remedial system.	Alternative G-3 includes continued operation and optimization of the groundwater remediation system, which already includes off-gas treatment systems for the air strippers and the vacuum enhanced recovery system that were designed to meet air discharge standards. These off-gas treatment systems are/will be monitored and maintained to ensure air emissions continue meet discharge standards. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	Relevant and Appropriate
	Massachusetts Threshold Exposure Limits (TELs) and Allowable Ambient Limits (AALs) for Ambient Air	The Massachusetts Department of Environmental Protection has issued guidance setting out permissible concentations of air toxics in ambient air. The TELs and AALs are used to guide permitting decisions for sources of air toxics.	Remedial activities under Alternative G-3 will be monitored to ensure remedial air emissions do not cause any exceedances of TELs and AALs. Under CERCLA, only the substantive requirements of these regulations would apply to this alternative.	To Be Considered

AALs - Allowable Ambient Limits
ARARs - Applicable or relevant and appropriate requirements.
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act.
CFR - Code of Federal Regulations.
CMR - Code of Massachusetts Regulations
COCs - Contaminants of Concern
CSFs - Cancer Slope Factors
CWA- Clean Water Act.
EPA - Environmental Protection Agency.
GAC - Granular Activated Carbon
GWQS - Groundwater Quality Standards
LUCs - Land Use Controls
MGL - Massachusetts General Laws
NPDES-National Pollutant discharge elimination system.
ppm - parts per million
ppmv - parts per million by wieght
RCRA - Resource Conservation and Recovery Act.
RfDs - Risk Reference Doses
SDWA - Safe Drinking Water Act.
TELs - Threshold Exposure Limits
TSD - Treatment, Storage and Disposal
USC - United States Code.
VOC - Volatile Organic Compounds

APPENDIX
E

Appendix E - MADEP Concurrence Letter

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
ONE WINTER STREET, BOSTON, MA 02108 617-292-5500

DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lieutenant Governor

IAN A. BOWLES
Secretary

LAURIE BURT
Commissioner

September 28, 2007

James T. Owens, Director
Office of Site Remediation and Restoration
Region 1
U.S. Environmental Protection Agency
One Congress St., Suite 1100 (HIO)
Boston, MA 02114-2023

Re: ROD Concurrence Letter
Operable Unit 1
Hanscom Air Force Base, Bedford, MA

Dear Mr. Owens:

The Massachusetts Department of Environmental Protection (MassDEP) has reviewed the Record of Decision (ROD) and the Selected Remedy recommended by the U.S. Air Force for Operable Unit 1 (OU-1) at the Hanscom Air Force Base Superfund Site. For the reasons described below, the Department concurs with the Selected Remedy for the Site.

OU-1 consists of property that includes Hanscom AFB, an active military base owned and operated by the Federal government through the Department of the Air Force (USAF) located in Bedford, Lincoln, and Lexington, MA. OU-1 also includes the property Hanscom Field, located adjacent to and north of the Base, which is a full-service General Aviation airport owned by the Commonwealth of Massachusetts and operated by the Massachusetts Port Authority and the Federal Aviation Administration. Hanscom Field was leased from the Commonwealth and used as a military airport by the Air Force from 1942 to 1973. Groundwater beneath OU-1 is contaminated with volatile organic compounds as the result of historical USAF activities.

The Selected Remedy addresses groundwater contamination and residual soil contamination through a combination of continued operation of the existing groundwater remediation system, Land Use Controls/ Institutional Controls, the monitoring of groundwater and surface water, and conducting Five-Year Reviews as long as any hazardous substances, pollutants or contaminants remain at the site above levels that allow for unrestricted exposure and unlimited use. This remedy is expected to treat the sources of groundwater contamination, effectively contain the migration of groundwater contaminants, reduce the overall extent of the groundwater plume via a reduction in contaminant mass, and prevent exposure to residually contaminated soils. The Selected Remedy is based on a future use scenario of an active airfield and conservation land.

The Selected Remedy for this site is a comprehensive approach that is intended to address all current and potential future exposures and subsequent risks caused by soil and groundwater contamination.

If you have any questions regarding this letter, please contact Garry Waldeck, Project Manager at (617) 348-4017 or Jay Naparstek, Deputy Division Director at (617) 292-5697.

Sincerely,

Laurie Burt
Commissioner
Bureau of Waste Site Cleanup

CC: Mr. Thomas Best USAF

Appendix G

Appendix G – July 27, 2007 Letter from Conservation Commission, Town of Bedford, Re: Hartwell Town Forest and Jordan Conservation Area

TOWN OF BEDFORD

BEDFORD, MASSACHUSETTS 01730

TTD/TTY: 781-687-6124

CONSERVATION COMMISSION

Robert Kenyon
Chair
Elizabeth Bagdonas
Conservation Administrator

Town Hall
10 Mudge Way
Bedford, MA 01730-2144
Phone 781-275-6211
Fax 781-275-1334
Email elizabeth@town.bedford.ma.us

July 27, 2007

Mr. Thomas Best, IRP Manager
66 MSG/CEG, 120 Grenier Street
Hanscom Air Force Base, MA 01731

Re: Hartwell Town Forest and Jordan Conservation Area

Dear Mr. Best:

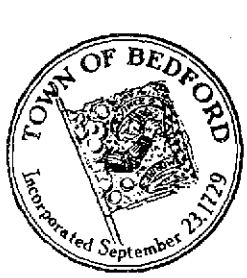
The attached correspondence from Joseph O'Keefe requests information on the management and land use status of two Bedford conservation areas, the Hartwell Town Forest and George Jordan Conservation Area.

In 1940, the Hartwell Town Forest was accepted by the Town as a gift, "to be placed under the Town Forest Act". *[Reference: History of Hartwell Town Forest]*

The 1957 Conservation Commission Act (Massachusetts General Laws Chapter 40 section 8C) authorized the establishment of a locally appointed municipal agency (the Commission), whose role was to protect natural resources, acquire important land and water areas, and manage these properties for conservation and passive recreation. *[Reference: MACC Environmental Handbook, p. 1]*

At the 1977 Annual Town Meeting, the Town voted to assign jurisdiction over Hartwell Town Forest to the Conservation Commission. According to a 1997 opinion from Town Counsel, a town forest is part of the "public domain" under section 19 of C. 45 of the General Laws. Section 19 says in relevant part that "such public domain shall be devoted to the culture of forest trees, or to the preservation of the water supply of such city or town..."

TOWN OF BEDFORD
BEDFORD, MASSACHUSETTS 01730



TTD/TTY: 781-687-6.

Chapter 40, section 15A requires the Conservation Commission to approve change in use and/or transfer of control, but this law does not entirely override the forest's public trust status since it was a gift to the town. For that matter, town meeting must also agree to a change in both use and control. The potential change in use and the nature of the change in legal or physical control would also need to be analyzed in light of Article 97 which protects the public right to freedom from excessive and unnecessary noise, among others. Article 49 of the Articles of Amendment to the Massachusetts Constitution (inserted in its present form by the 97th Article of Amendment in 1972) says in relevant part:

> "The people shall have the right to clean air and water, freedom from excessive and unnecessary noise, and the natural, scenic, historic, and aesthetic qualities of their environment; and the protection of the people in their right to the conservation, development and utilization of the agricultural, mineral, forest, water, air and other natural resources is hereby declared to be a public purpose." *[Reference: 1997 Town Counsel Report]*

The George Jordan Conservation Area was conveyed to the Town in 1971 "through its Conservation Commission, for administration, control and maintenance", under the provisions of Massachusetts General Laws, Chapter 40, section 8C – the "Conservation Commission Act". The option to purchase, further states that the land shall be "managed and controlled by the Conservation Commission of the Town of Bedford for the promotion and development of the natural resources and for the protection of the watershed resources of said Town."

Please do not hesitate to contact the Commission if you would like more information on the Hartwell or Jordan conservation areas.

Sincerely,

Elizabeth J. Bagdonas

Elizabeth J. Bagdonas
Conservation Administrator